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The Impact of Diet And Psychosocial Factors Post Bariatric Surgery

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THE IMPACT OF DIET AND PSYCHOSOCIAL FACTORS POST BARIATRIC SURGERY

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ABSTRACT

THE IMPACT OF DIET AND PSYCHOSOCIAL FACTORS POST BARIATRIC SURGERY

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Bariatric surgery is a medical procedure that has been found to be an effective option for weight loss. Despite the benefits of bariatric surgery, little is known about the psychosocial factors that may impact weight outcome. The present study attempted to examine patients' level of perceived stress, depressed mood, and diet, and the association of these factors with percent weight loss in the first 6-months after surgery. Eighty patients completed pre- and 6-months post-operative depressed mood assessment (Patient Quality Health Questionnaire – 7 [PHQ-7]), a perceived stress measure (Cohen's Perceived Stress Scale – 10 [PSS-10]), and dietary measures (Block Dietary Fruit-Vegetable-Fiber Screener, Block Dietary Fat Screener, Eating and Diet Questionnaire). A protein guideline sheet was also provided to research participants at each visit.

Paired samples *t*-tests supported pre- and 6-month post-operative significant decrease in depressed mood. Perceived stress was hypothesized to decrease between pre- and 6-month post-operative visits. However, the finding was not supported although the change noted was in the hypothesized direction. To better address the hypothesis of high fat meat consumption and its impact on weight outcome at 6-months after surgery, five high fat items from the Block Dietary Fat screener were identified. A regression analysis model found that there was no statistically significant association between change in consumption of high-fat meat and percent weight loss. Further, the relationship between

changes in stress and healthy eating and changes in depressed mood and healthy eating were only significant pre-operatively – not at the 6-month post-operative visit. Lastly, a path analysis indicated no indirect or direct effects of the mediating relationships between changes in depression, stress, healthy diet, and percent weight loss. However, there was a significant direct effect between changes in healthy diet and percent weight loss.

Despite several limitations of this study, these findings provide additional information about the 6-month changes in depressed mood, perceived stress, and diet in bariatric patients. Therefore, this critical post-operative time period warrants further empirical focus, as this is an understudied area in the bariatric population.

Co-Directors: Dr. Barbara A. Cubic
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To my mother.
Thank you for your infinite love, reassurance, and support.

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CHAPTER 1

INTRODUCTION

Alarming rates of obesity in the U.S. have garnered much interest. The prevalence of obesity among adults in the U.S. between 2015 and 2016 was 39.8% and 18.5% in youth (Hales, Carroll, Fryar, & Ogden, 2017). Globally, more than 1.9 billion adults were identified as overweight in 2016 and of those, 650 million were obese (World Health Organization [WHO], 2018). It is projected that if obesity rates continue to rise, most of the world's adult population could either be overweight or obese by 2030 (Kelly, Yang, Chen, Reynolds, & He, 2008).

Obesity is defined as excess body fat (WHO, 2000) and was notably labeled as a disease in 2013 by the American Medical Association (AMA; Stoner & Cornwall, 2014). To diagnose obesity, the Body Mass Index (BMI) is often used to determine an individual's weight status by calculating an individual's body adiposity by dividing weight in kilograms by height in meters squared (kg/m^2; Wadden, Brownell, & Foster, 2002). The WHO (WHO, 2000) classifies BMI into six categories: Underweight (BMI <18.5), Normal weight (BMI 18.5-24.9), Overweight (BMI 25-29.9), Class I obesity (BMI 30-34.9), Class II obesity (BMI 35-39.9), and Class III obesity or "morbid obesity" (BMI ≥ 40 kg/m^2). Research suggests that an estimated 35.7% and 5.7% of adults are classified as Class II and Class III obesity, respectively (Ogden, Carroll, Kit, & Flegal, 2012a; Flegal, Carroll, Ogden, & Curtin, 2010). Additional categories such as "super obesity" (BMI >50.0) and "super-super obesity" (BMI ≥60.0) have also been identified (Yoshizawa et al., 2018).

There are limitations, however, with measuring weight status with BMI, as BMI is unable to discern between fat and lean body mass (Bergman et al., 2011; Wells &

Fewtrell, 2006). Consequently, several methods have been developed to assess body fat or adiposity. Although expensive and cumbersome, hydrodensitometry (i.e., underwater weighing) and dual-energy X-ray absorptiometry (DXA) are two approaches that are found to most accurately quantify body fat, and computed tomography (CT) and magnetic resonance imaging (MRI) both measure body fat distribution (Bergman et al., 2011). Despite the availability of numerous methods (e.g., waist-to-hip ratio, skin-fold thickness) to assess adiposity, the best anthropometric tool to measure obesity is yet to be found. Nevertheless, BMI is still considered a surrogate to the formal methods for assessing adiposity given its convenience and practicality (Flegal, 2010).

The feasibility of using BMI in research has led to addressing obesity and its relationship with several adverse medical concerns including, cardiovascular disease (CVD), hypertension, dyslipidemia, stroke, glucose intolerance, and cancer. Subsequently, due to its serious impact on health, obesity and ways to combat it have been heavily researched (Center for Disease Control [CDC], 2015). The causes of obesity are multifactorial and include the interplay of genetically predisposing, lifestyle, environmental, and psychosocial factors (Herrera, Keildson, & Lindgren, 2011), which thereby warrant national and global concern. These concerns are especially reflective from the National Health and Nutrition Examination Survey, 2013 – 2016 that indicate Hispanic men had a significantly higher prevalence of obesity compared to non-Hispanic white men (40.6% vs 36.2%; Hales et al., 2018). For women, there is a higher prevalence of obesity among non-Hispanic black women compared with non-Hispanic white women (55.9% vs 38.1%; Hales et al., 2018).

In addition to an increase in obesity rates in the adult population, recent data suggest that the prevalence of obesity is rising among children and adolescents despite past research indicating obesity rates in children and adolescents have been stable (Skinner et al., 2018). Since the last National Health and Nutrition Examination Survey cycle, 2013-2014 and 2015-2016, the prevalence of class I obesity among 2-to 5-year-olds indicated a “sharp increase”, notably in males (Skinner et al., 2018, p. 3). Another increase from 36% to 48% was found among older adolescent females in the overweight class. Furthermore, recent obesity trends were found among ethnically diverse children and adolescents. Hispanic and Non-Hispanic Black children had higher rates of all classes of obesity in comparison to other ethnicities (Ogden et al., 2012b; Skinner et al., 2018).

It is evident that obesity does not discriminate against adult, adolescents, or children, thus leading researchers to continue to examine the health consequences of and environmental influences on obesity. Deciphering whether obesity is a sole factor that affects mortality rates has proved to be particularly challenging (Hu, 2008) given that obesity can be linked to various factors such as age, sex, cigarette smoking, CVD, hypertension, dyslipidemia, stroke, type 2 diabetes, and cancer (Buchwald et al., 2004; CDC, 2015). It is these variables that have complicated statistical calculations and in turn have produced inconsistent results (Hu, 2008). However, several epidemiological studies corroborate that individuals with obesity are at a greater risk for life-threatening chronic health conditions, with estimates indicating that in 2013, one in three adults worldwide were classified as overweight or with obesity (Hruby & Hu, 2015).

Almost four decades ago obesity was linked to increased mortality in several studies even when age, blood pressure, smoking, cholesterol, and diabetes were statistically controlled (Hubert, Feinleib, McNamara, & Castelli, 1983). The American Cancer Society examined mortality rates over a 14-year period and found that individuals who had a higher BMI are at a greater risk for mortality (Calle, Thun, Petrelli, Rodriguez, & Heath, 1999). Additionally, the study showed that men and women who had never smoked and who had no history of disease, but had a BMI ≥ 40 kg/m^2 had the highest mortality rates compared to individuals who smoked and had history of disease (Calle et al., 1999).

The seriousness of the implications of obesity and mortality rates warrant empirical focus on common correlates. CVD has been identified as the leading cause of mortality and studies have found that hypertension (i.e., high blood pressure) is one common illness that correlates with obesity (Brown, Meehan, & Gorden, 2015; Jiang et al., 2016). Blood pressure is defined as the amount of blood the heart pumps and the amount of resistance to blood flow in the arteries. When hypertension is controlled and treated, the systolic blood pressure (i.e., pressure in the arteries) and the diastolic blood pressure (i.e., measure of blood between heartbeats) can average below 140/90 mmHg (CDC, 2011). The activation of the sympathetic nervous system (SNS), high amounts of intra-abdominal and intra-vascular fat, and sodium retention can lead to an increase in kidney reabsorption that contributes to the pathogenesis of obesity-related hypertension, blood pressure persistently at or >140/90 mmHg (Jiang et al., 2016). It is believed if patients with hypertension were treated more effectively with a healthier lifestyle, including a heart-healthy diet, abstinence from smoking and drinking high amounts of alcohol, 46,000 deaths could be prevented yearly (CDC, 2011; Jensen et al., 2008).

Another factor that may be contributing to CVD is dyslipidemia, a condition in which abnormal level of lipids (e.g. cholesterol and/or fat) in the blood are indicated by low levels of high-density lipoprotein-cholesterol (HDL-C) or high levels of low-density lipoprotein cholesterol (LDL-C; Brown et al., 2012). Changes in lipid profiles such as decreased high-density lipoprotein cholesterol and increased triglyceride levels are evident among individuals with obesity. The average serum cholesterol level is found to be significantly higher among individuals with obesity and overweight compared to their normal weight counterparts (Miettinen, 1971). Thus, the relationship between dyslipidemia and obesity has serious implications, as it is related to the increase risk of coronary heart disease (Klop, Elte, & Cabezas, 2013; Franssen, Monajemi, Stroes, & Kastelein, 2011).

Diabetes similarly is associated with obesity and has been shown to contribute to coronary heart disease, congestive heart failure, and cardiac death. Diabetes is known as a group of diseases that can be defined as an individual having high levels of blood glucose (i.e., sugar). High blood glucose levels can either disrupt how insulin is produced, how it physiologically works, or both (CDC, 2014). Individuals that are diagnosed with diabetes are at a higher risk for developing heart disease, stroke, hypertension, high levels of LDL-C, and kidney disease (CDC, 2014). There are two common types of diabetes. Type 1 diabetes is a chronic condition in which the pancreas produces little or no insulin. Type 2 diabetes (T2DM) is a disease in which insulin deficiency co-occurs among individuals with obesity (Taylor & Holman, 2015). Of the two types of diabetes, T2DM is the more common form. According to the National Diabetes Statistics Report from 2014, findings suggest that T2DM accounts for approximately 90% to 95% of all cases of diabetes (CDC, 2014). Age, obesity, family history of diabetes, history of gestational diabetes, impaired glucose metabolism, physical inactivity, and race/ethnicity are risks associated with the development of T2DM (CDC, 2014).

When an individual has high cholesterol, their arteries can block the normal flow of blood to the brain, which may precipitate a stroke. Approximately 130,000 deaths per year in the United States are due to strokes and more importantly, strokes are found to be the third leading cause of death after heart disease and cancer (CDC, 2014; Curioni, Andre, & Veras, 2006). The association between strokes and obesity is unclear, but many researchers suggest that 18% to 20% of ischemic strokes can occur when BMI is above 28.1 kg/m^2, waist circumference greater than 100 cm, or waist-to-hip ratio greater than .95 (Kizer et al., 2010).

Similar to the relationship between ischemic strokes and obesity, there is evidence that suggests that higher amounts of body fat are associated with risk factors for cancer. Risk factors associated with cancer include tobacco and alcohol use, unhealthy diet, and physical inactivity. It is estimated that approximately 20% of all cancers are due to excess body weight (Wolin, Carson, & Colditz, 2010; De Pergola & Silvestris, 2013). Furthermore, an increase in cancer-related mortality is seen among individuals with obesity (Chen, 2011; Calle & Kaaks, 2004). The International Agency for Research on Cancer (IARC) Working Group on the Evaluation of Cancer-Preventive Strategies suggests that the prevention of weight gain decreases the risk of developing cancers of the colon, breast (in postmenopausal women), endometrium, kidney, and oesophagus (Calle & Kaaks, 2004). For men, colon cancer and obesity can co-occur due to central adiposity (Calle & Kaaks, 2004).

Environmental Factors and Impact

The term “obesogenic” environment (Geier, Rozin, & Wansink, 2012; Brownell, 2002; Hill & Peters, 1998) has been coined to describe a conglomeration of factors that may contribute to weight gain and obesity (Hill & Peters, 1998) including food availability, larger portion sizes, diet composition, and sedentary lifestyles. In fact, it is suggested that the increase in the prevalence of obesity is primarily associated with behavioral factors more so than genetic composition (Wadden et al., 2002). Other behavioral factors such as sleep deprivation, increase in smoking, and alcohol intake (Hankinson et al., 2013) have also been associated with obesity and the "obesogenic" lifestyle (Kruger, Ham, & Prohaska, 2009).

The obesogenic lifestyle includes complex relationships, particularly between diet and the food industry. For example, over time, portion sizes have increased and even exceeded the Food and Drug Administration (FDA) recommendation of standard portion sizes (Nielsen and Popkin, 2003). Between 1977 and 1996 an average portion size of salty snacks increased from 1.0 to 1.6 ounces and soft drinks consumed increased from 13.1 to 19.9 ounces (Nielsen & Popkin, 2003). As a way to rationalize the apparent increase in portion sizes, individuals are duped into purchasing items for the "best value" by disregarding the larger portion sizes, thereby leading to any subsequent consumption of increased calories (Hill & Peters, 1998).

Food expenditures have also steadily increased approximately 17% from 1970 to 2007 (Mancino, Todd, & Lin, 2009). This trend not only may influence rates of obesity, but it also suggests that a high consumption of meals outside of the home is associated with high body fatness or high BMI (Kruger, Blanck, & Gillespie, 2008). The United States Department of Agriculture (USDA) reports that energy content is higher from fast food restaurants and/or commercially prepared food than meals that are prepared at home (Kant & Graubard, 2004). A study conducted with premenopausal women found that individuals who frequently ate outside the home (between six and 13 times per week) consumed significantly more calories (2,057 kcal) than individuals who ate outside the home five times or less per week (1,769 kcal; Clemens, Slawson, & Klesges, 1999). Due to the increase in the meals consumed outside the home, there is a national decline in prepared, cooked meals at home (Robson, Crosby, & Stark, 2016; USDA, 2014; Guthrie, Lin, & Frazao, 2002).

Another factor that may be contributing to the “obesogenic” lifestyle is low level of physical activity (Hill & Peters, 1998). Individuals who do not achieve the recommended guidelines for physical activity are likely to engage in sedentary behaviors that include watching television, spending time on the computer, and playing video games (Hill & Peters, 1998).

Although there is little understanding of the link between weight response and varying diet composition, Riera-Crichton and Tefft (2014) examined macronutrient intake in the obese population and found that an increase in carbohydrates was significantly associated with an increase obesity prevalence and BMI. Another study examined macronutrient intake, more specifically protein intake, among patients that were randomized into three diet patterns in which a higher protein and lower carbohydrate intake was encouraged (Swain et al., 2008). The diet included fruits, vegetables, low-fat dairy products, whole grains, poultry, fish, and nuts. A reduction of red meat, sweets, and sugar-containing beverages was also emphasized and encouraged (Swain et al., 2008). The results showed that patients who replaced carbohydrates with protein or unsaturated fats had better blood pressure measures, total low-density lipoprotein cholesterol, and triglycerides levels (Swain et al., 2008; Appel et al., 2005; Hankinson et al., 2013).

The Diabetes Control and Complications Trial and the Finnish Diabetes Prevention Study are two clinical trials that examined diabetes and diet among patients with obesity. Results showed that there was a significant reduction (58%) of the occurrence of diabetes by maintaining a diet and exercise regimen (Hankinson et al., 2013; The Diabetes Control and Complications Trial Research Group, 1993; Tuomilehto et al., 2001). Not only was there a reduction in the incidence of diabetes, but patients who had changed their diet also demonstrated modest weight losses (<10% of initial body weight; Hankinson et al., 2013).

Treatments for Obesity

Given these significant health implications, obesity treatment is a critical healthcare need. Numerous approaches such as behavioral, pharmacological, and surgical interventions have been developed to treat different classes of obesity. For instance, behavioral and pharmacological interventions are effective for individuals in overweight and Class I obesity and surgical or bariatric interventions are reserved for individuals with morbid obesity (BMI $\geq$ 40 kg/m^2, or $\geq$ 35 kg/m^2 with comorbidities; Vetter Faulconbridge, Williams, & Wadden, 2012). While there are various FDA approved medications to treat obesity, there are also other treatments that focus on lifestyle changes including improving physical activity, diet plans, and behavioral modifications. Patients who participate in behavioral modification groups attend lifestyle intervention sessions that focus specifically on the behaviors related to weight gain and tend to lose an initial 10% of their body weight (Wadden, Webb, Moran, & Bailer, 2012). Studies have shown that long-term weight loss is feasible with continued behavioral treatment (Wadden et al., 2012). However, when behavioral and pharmacological treatments are not effective, surgical interventions, such as bariatric surgery, are a viable option to treat morbid obesity.

Behavioral Interventions

Behavioral treatments for obesity explore the underlying maladaptive eating patterns and physical activity an individual engages in and then utilizes a set of principles and skills to modify unhealthy behaviors (Lagrotte & Foster, 2012). The founding principles for behavioral treatments for obesity are based on classical conditioning. For instance, eating is prompted by antecedent events (i.e., triggers) that activate the association of food intake (Lagrotte & Foster, 2012). Therefore, behavioral interventions assist individuals to learn and effectively apply skills that reinforce positive behaviors by understanding how thought patterns (or cognitions) influence emotions and behaviors. The implementation of cognitive techniques or cognitive behavioral therapy (CBT) make the process practical for weight loss patients, as it is goal-oriented, time-limited, and structured (Lagrotte & Foster, 2012).

In addition to addressing maladaptive eating patterns and physical activity, many behavioral treatment programs include self-monitoring methods, in which individuals are encouraged to keep food and activity records, education on stimulus control (i.e., cues linked to eating), education on pace of eating, and provided with ways to problem-solve how to overcome weight loss barriers. Manuals such as the Lifestyle, Exercise, Attitudes, Relationships, and Nutrition (LEARN) program for weight management promote change in a holistic approach by addressing many domains such as listening to hunger cues, coping with lapses in healthy behaviors and preventing relapses, how to stay motivated, and guidelines for setting weight loss goals in 12 sessions (Brownell, 2000).

Despite the effectiveness of weight loss behavioral programs that focus on eating behaviors, meal replacements have also been introduced as an alternative behavioral treatment. Meal replacements include replacing two out of three meals with liquid and/or solid meal replacement or at least two portion sized meals (Lagrotte & Foster, 2012). Patients have been found to have greater weight loss with meal replacements compared to individuals who follow a self-selected meal plan. A meta-analysis that combined six studies examined the effectiveness of a meal replacement as a strategy for weight loss. Results showed that patients who consumed meal replacements lost approximately 7% to 8% body weight compared to those who were on a reduced calorie diet plan (3% to 7% body weight) at one year (Heymsfield, van Mierlo, van der Knapp, Heo, & Frier, 2003; Lagrotte & Foster, 2012).

The majority of the research on behavioral treatment for obesity is conducted on commercial weight loss programs, as university-based clinical programs explain little about the effectiveness of behavioral treatments outside clinical settings. Individuals with a BMI between 27 kg/m^2 and 29.9 kg/m^2 are encouraged to join commercial weight loss programs, as they are found to have promising results. The data show that individuals who join Weight Watchers lose more weight (4.6%) than individuals who are assigned to a self-help group after one year (1.7%; Lagrotte & Foster, 2012; Heshka et al., 2003).

Pharmacological Treatments

The National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH) recommends approving individuals with a BMI of 30 kg/m^2 or with a BMI of 27 kg/m^2 with comorbidities for pharmacological treatments supported by the Food and Drug Administration (FDA). Phentermine was the first FDA approved weight loss medication that is part of the B-phenethylamine family that promotes anorexia. Despite the significant weight loss outcomes, phentermine causes many physiological side effects that include insomnia, palpitations, tachycardia, dry mouth, constipation, restlessness, euphoria, nervousness, increased pulse rate, and elevated blood pressure and is only meant for short-term treatment of obesity.

Sibutramine (i.e., Meridia) was an accepted weight loss medication and approved by the FDA in 1997, but was withdrawn from the market due to an increase in cardiovascular events such as heart attack and stroke. Currently, orlistat (i.e., Alli) is a medication that is approved by the FDA for long-term management of obesity and promotes weight loss by preventing pancreatic and gastrointestinal lipases (Rosen & Aronne, 2012; Korner & Aronne, 2004). Other current pharmacological treatments for weight loss include Qnexa, which is a combination of phentermine and topiramate; Contrave, a combination of bupropion and naltrexone; and Belviq or lorcaserin (Rosen & Aronne, 2012).

Despite the physiological side effects, studies have shown that pharmacological interventions show potential in addressing obesity and improving cardiovascular health (Cunningham & Wiviott, 2014). Due to the testament of pharmacological interventions, many novel weight loss medications are in development, as the FDA continues to evaluate new medications for the treatment of obesity (Cunningham & Wiviott, 2014).

Bariatric Surgery

When behavioral treatments are not successful, studies have found that the most effective weight control option for individuals with Class III obesity (BMI $\geq$ 40 kg/m^2) or a BMI of 35 kg/m^2 (i.e., Class II) with comorbidities, including type 2 diabetes, hypertension, and sleep apnea, is bariatric surgery (Vetter, et al., 2012). Bariatric surgery is a procedure performed on individuals with morbid obesity (i.e., a weight that is 100 or more pounds higher than ideal) to assist with restricting the amount of food the stomach can hold. Bariatric surgical procedures are associated with improved overall health outcomes including, a reduction in cardiovascular factors and weight (Sarwer, Wadden, Fabricatore, 2005). The involvement of multidisciplinary teams throughout the bariatric surgical process is essential. Most bariatric clinics consist of a team that includes a bariatric surgeon, bariatric coordinator, clinical psychologist, registered dietitian, endocrinologist, sleep medicine specialist, cardiologist, gastroenterologist, and office support personnel. The role of a clinical psychologist and the inclusion of a psychological evaluation are paramount in this process. The psychological evaluation helps patients not only identify their strengths, but also delineate areas (i.e., mood stability, eating behaviors) where extra support may be warranted for favorable Post-operative outcomes. Thorough psychological evaluations can also screen out those individuals who would not likely succeed at sustaining the lifestyle necessary for bariatric surgery to be effective and facilitate those patients seeking more appropriate types of weight loss intervention.

Generally, the psychological evaluation combines a clinical interview and psychological assessment with the aim of identifying potential contradictions to surgery, such as substance abuse, poorly controlled psychiatric illnesses (e.g., depression), severe eating patterns, and other psychosocial issues (e.g., BED; Mechanick, 2008). Additionally a patient's weight and diet history, social background, motivation and preparedness, and eating behaviors are assessed during the clinical interview while the psychological assessment may focus on the patients' mood symptoms, eating patterns, and physical activity habits (Mechanick, 2008). Due to the comprehensiveness of the psychological evaluation, clinical psychologists have the authority to approve, deny, or delay a patient for bariatric surgery (Mechanick, 2008). Approximately 75% of bariatric surgery candidates are approved for surgery and the remainder are either denied due to the contraindications mentioned above, or surgery is delayed until specific psychosocial and/or nutritional issues have been addressed (Mechanick, 2008).

Bariatric Procedures

The success of bariatric surgery has allowed the development of several bariatric procedures available for individuals who fall into Class III obesity (Vetter et al., 2012).

The first bariatric surgical procedure, jejunoileal bypass, was introduced in 1954 (Mechanick et al., 2008), and produced significant weight loss. Although results were positive, complications including amino acid deficiency, fat soluble vitamin deficiency, gallstones, arthritis, fatigue syndrome, bypass encephalopathy, and bypass dermatitis, halted it from being performed on future patients (Mechanick et al., 2008). Nevertheless, this prompted the development of more advanced and less risky bariatric procedures (Mechanick et al., 2008).

Bariatric surgery can be classified as either a restrictive or a malabsorptive procedure, or both (Vetter et al., 2012). Restrictive procedures decrease the volume of the stomach in order to limit food intake while leaving the gastrointestinal tract intact. Two restrictive bariatric surgical procedures are the laparoscopic adjustable gastric band and vertical sleeve gastrectomy. Malabsorptive procedures shorten the small intestine that reduces nutrient absorption. Malabsorptive and restrictive procedures include the biliopancreatic diversion with duodenal switch and the roux-en-Y gastric bypass (RYGB; Vetter et al., 2012). Given that there are different types of bariatric surgery, deciding which surgery is appropriate relies on the patient's preference, the bariatric surgeon and their expertise with the surgeries (Mechanick et al., 2008).

Laparoscopic adjustable gastric band. The adjustable gastric band is an operation with minimal physical invasion and is considered to be a restrictive procedure, as an inflatable silicone adjustable band is placed around the top portion of the stomach, slowing down the consumption of food (Vetter et al., 2012). The band can be adjusted by adding or removing saline through a small port placed in the abdomen. The adjustable gastric band has positive weight loss outcomes for patients with a BMI over 45 kg/m^2 (O'Brien & Dixon, 2003). On average it is reported that patients lose 56% of excess weight five years from surgery (O'Brien & Dixon, 2003). Although there are improvements in medical conditions, such as diabetes, hypertension, and gastroesophageal reflex disease (GERD), long-term complications with the adjustable gastric band have been noted. Approximately 22% to 50% of patients have required removal of the gastric band due to band erosion, band slippage, and band intolerance (Vetter et al., 2012; Himpens et al., 2011).

Vertical sleeve gastrectomy. The vertical sleeve gastrectomy is another restrictive procedure that is the first stage of a two-part procedure (Smith, Schauer, & Nguyen, 2011). The second stage is either a gastric bypass or duodenal switch. The sleeve gastrectomy consists of the removal of an estimated 75% original size of the stomach (Vetter et al., 2012), leaving the stomach to look like a sleeve or tube. Studies have found that the vertical sleeve gastrectomy leads to stable weight loss with mean percent excess weight loss of 57.5% to 55% for the first five years after surgery (Bohdjalian et al., 2010). Although weight loss is a positive outcome, the sleeve gastrectomy is limited in success, as weight regain and the development of GERD are two negative postsurgical consequences (Bohdjalian et al., 2010). Given the serious complications that include postsurgical leakage, vomiting due to overeating, consumption of high fat, or sugar dense foods (Rusch & Andris, 2007), the procedure is often times recommended to patients with a BMI > 60 kg/m^2 (Vetter et al., 2012).

Biliopancreatic diversion with duodenal switch. Biliopancreatic diversion (BPD) is a surgical procedure that involves partial gastrectomy, in which the food bypasses the small intestine in order for fewer calories to be absorbed. The duodenal switch (BPD-DS) is a variation of BPD in which the sleeve of the stomach is left with the pylorus and the duodenum is left at the end. The vagal nerve is left intact in order to refrain from the risk of "dumping" syndrome, which consists of food bypassing the stomach and entering the small intestine (Vetter et al., 2012). Dumping causes a visceral reaction in which abdominal pain and cramping, nausea, diarrhea, light-headedness, flushing, tachycardia, and syncope are common symptoms (Mechanick et al., 2008) and lead patients to feel extremely uncomfortable. Although considered to be a successful procedure for weight loss, the BPDS has numerous complications that include leaks and ulcerations, chronic loose stools, protein malnutrition, vitamin deficiencies, and anemia (Vetter et al., 2012). Given the serious complications, BPDS is not frequently performed and accounts for 5% of all bariatric procedures in the United States. It is usually performed as a last resort for individuals with a BMI > 50 kg/m^2.

Roux-en-Y-gastric bypass. The Roux-en Y gastric bypass (RYGB) surgery is considered to be the gold standard treatment for extreme obesity (Vetter et al., 2012; Rubino, 2006; Shah, Simha, & Garg, 2006; Maggard et al., 2005), as it is the safest and most efficacious (Smith, Schauer, & Nguyen, 2011) out of all the surgical procedures. The RYGB is a procedure in which the upper part of the stomach is sectioned off to create a separate small pouch and the small intestine is rerouted to the gastric pouch, which thereby forms a Roux limb. The RYGB is performed more than half of the time (Vetter et al., 2012) using a laparoscopic technique in order to refrain from surgical complications. Results show that individuals who undergo a RYGB have reported weight loss of 60% to 70% of excess body weight (Schauer et al., 2000). Despite the successful amount of weight loss, complications of RYGB include leaks at the site, acute gastric dilatation, ulceration, wound hernias, vomiting, and the dumping syndrome (Vetter et al., 2012).

Though bariatric surgery is the most effective weight control option available for individuals with a BMI of 30 or more, non-invasive weight loss procedures are a surrogate for individuals who are less inclined to opt for surgical weight loss interventions (Lopez-Nava, Galvao, de Bautista-Castano, De Grado, & Fernandez-Corbelle, 2015). The endoscopic sleeve gastroplasty procedure (also known as the accordion procedure) uses an endoscopic suturing device to reduce the size of a stomach without the need for surgery. Due to the nature of the procedure, complications are limited (Lopez-Nava, et al., 2015). More importantly, the results of the accordion procedure are promising, as patients reached 54.6% excess weight loss (EWL) and 18.7% total body weight loss (TBWL; Lopez-Nava et al., 2015).

The gastric balloon is another non-invasive option in which patients swallow a capsule with water and enters the stomach (location confirmed by x-ray; Raftopoulos & Giannakou, 2017). Results indicated 50.2% %EWL and 14.6% %TWL after 12-months, which is considered comparable to studies implementing nutrition counseling (Raftopoulos & Giannalou, 2017).

Psychosocial Factors

Psychological symptoms have long been understood as an obesity correlate rather than a primary cause (Malik, Mitchell, Engel, Crosby, & Wonderlich, 2014), however, it is not to say that the high prevalence of psychopathology in the obese population should be neglected as an area of focus. Individuals with symptoms of depression and anxiety may also be seeking treatment for obesity (Malik et al., 2014). U.S. adults aged 20 and over were surveyed from 2005-2010 and 34.6% were classified with obesity and of those 7.2% presented symptoms of depression in the past two weeks (CDC, 2010).

Depression can be characterized as an illness in which an individual experiences symptoms of sadness, hopelessness, and difficulty functioning on a daily basis. Researchers have found that obesity and depression share a bidirectional relationship (Blaine, 2008; Noh, Kwon, Park, & Kim, 2015). One model suggests that obesity initiates negative stereotyping and discrimination, which could be instigators for symptoms of depression. This is indicative of the several studies that have found individuals with obesity compared with adults without obesity are twice as likely to have depressed symptoms (Blaine, 2008). Another model suggests that depression affects obesity. Within this model, depression indirectly impacts obesity through behaviors such as emotional eating, eating calorie-energy dense foods, and decreased activity (Blaine, 2008; Noh et al., 2015).

Within the bariatric population, several studies show mixed results of changes in depressive symptoms before and after surgery. A study that measured mood found that 32.7% bariatric patients were clinically depressed before surgery and when assessed between 6 to 12 months post-surgery, depression levels decreased to 16.5% (de Zwaan et al., 2011; Booth et al., 2015). Despite substantiating evidence that mood improves after surgery, other studies suggest that mood worsens over time. For instance, data from the Longitudinal Assessment of Bariatric Surgery-2 (LABS-2), a study on bariatric patients, show changes in depressive symptoms during the first three years after bariatric surgery. The results indicated an increase in depressed scores from years 1 to 2 and 2 to 3, showing that patients' depressed mood had worsened over a three-year period (Mitchell et al., 2014). Possible reasons for the decline in depressed mood include disappointment from unrealistic expectations about bariatric surgery, weight regain, and/or reoccurrence of comorbidities (Mitchell et al., 2014).

Similar to the relationship between depression and obesity, the research on the association between anxiety and obesity shows mixed results. Anxiety can be characterized by psychological symptoms such as excessive worry, fear, apprehension, and physical symptoms such as fatigue, heart palpitations, and tension. Given that anxiety disorders are usually chronic, they are found to increase the risk of chronic health conditions, poor quality of life, and mortality. Obesity may be associated with anxiety disorders, as weight-bias and stigma are distressing to individuals with obesity and overweight (Gariepy, Nitka, & Schmitz, 2010; Puhl & Brownell, 2006). Some studies suggest a positive association between anxiety and obesity, while others have only found a moderate relationship. This inconsistency is partly due to methodological limitations such as, differences in measures used and small sample sizes (Gariepy et al., 2010; Sarwer et al., 2005). Despite researchers suggesting that the negative effects of obesity on health can influence an individual's anxiety, more research is warranted in understanding the variables that moderate the association between obesity and anxiety (Gariepy et al., 2010).

Stress is also an associated factor with obesity, as studies have found a link between individuals who experience uncontrollable amounts of stress and high BMI (Sinha & Jastreboff, 2013). Stress and its associated psychological symptoms impact individuals emotionally, and consequently lead to physical consequences. Chronic stress increases levels of cortisol, which change appetite/energy regulation (Sinha & Jastreboff, 2013; Torres & Nowson, 2007). Cortisol is an integral component in energy regulation that can affect an individual's eating pattern, especially when under stress. Individuals who are classified as overweight or with obesity and experience chronic stress are likely to engage in stress-related behaviors including, skipping meals, restraining intake, binging, snacking, and/or eating calorie-dense, palatable foods (Sinha & Jastreboff, 2013; de Zwaan, 2001). Mack and colleagues (2016) examined perceived stress in a 4-year follow-up study and found that bariatric patients with perceived less stress were better able to cope with stressors after surgery.

Emotional eating or eating in response to mood and stress has shown to be associated with poorer weight loss (Chesler, 2011). Although it is difficult for post-operative bariatric patients to engage in binge eating behaviors (described in more detail below) due to the restrictive nature of the surgery, they gradually can develop ways to re-engage in disordered eating patterns (Chesler, 2011; Rusch & Andris, 2007). Although post-operative patients do not expect the dietary restrictions from surgery to prohibit them from being social, the inability to consume alcohol or the larger portion sizes from eating out at restaurants often lead post-operative patients feeling stressed and/or isolated, which consequently may lead to disordered eating behaviors (i.e., snacking, grazing, overeating; Rusch & Andris, 2007).

To improve the success of an individual post bariatric surgery, it is important to be able to assess coping skills and to provide coping strategies as needed. The Millon Behavioral Medicine Diagnostic (MBMD; Millon & Antoni, 2006) is an instrument that includes bariatric surgery normative data on the following domains: response patterns, negative health habits, psychiatric indications, coping styles, and stress moderators (Marek, Heinberg, Lavery, Rish, & Ashton, 2016). The MBMD can be utilized to help clinicians with identifying maladaptive coping styles among bariatric patients (Figura et al., 2015; Fabricatore, Crerand, Wadden, Sarwer, & Krasucki, 2006).

For some, suboptimal weight outcomes are inevitable when faced with a multitude of adversities that could compromise post-operative success. As such, assessing for any maladaptive coping behaviors allows patients the opportunity to learn and implement stress management skills or ways on how to self-modulate intense emotions. Consequently, including assessment measures that assist with identifying coping styles can provide clinicians an opportunity to assist patients in learning effective coping strategies (Figura et al., 2015).

As part of the pre-surgical psychological evaluation, including personality measures such as the Minnesota Multiphasic Personality Inventory, Second Edition, Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008) can provide additional information with identifying current or past issues that could be potential risk factors for a suboptimal outcome (Marek et al., 2013). Psychological comorbidities are found to be fairly common in bariatric surgery patients (Marek et al., 2013) with studies reporting 68.6% and 29% of individuals meeting criteria for Axis I and Axis II personality disorders, respectively (Marek et al., 2013; Mitchell et al., 2012; Kalarchian, 2007).

For instance, Marek and colleagues (2013) found that in a sample of bariatric patients, scores were found to be within normal limits on validity and substantive scales in comparison to patients in the general population. However, within their sample, Marek and colleagues (2013) found above-average endorsed scores on Malaise (MLS), indicating that bariatric patients are likely to be preoccupied with poor health in addition to having low energy or sleep disturbance. This result confirms that weight-related medical comorbidities are found in the bariatric population (Marek et al., 2013). Additionally, Marek and colleagues (2013) found that higher scores on internalizing domains (i.e., Helplessness/Hopelessness, Self-Doubt, Inefficacy, Stress/Worry, Anxiety, Anger Proneness, Behavior-Restricting Fears, Multiple Specific Fears) were positively associated with maladaptive eating behaviors/diagnoses, Major Depression, and with a mental health history. Another study found that bariatric patients with elevated scores on the MMPI-2-RF scales including substance abuse and anxiety were considered 2.5 times at a higher risk for failing to proceed with bariatric surgery (Marek et al., 2017).

The MMPI-2-RF has also been utilized to examine the relationship between bariatric surgery and body image. Pona and colleagues (2016) found that patients who reported body image issues three months post surgery endorsed higher preoperative scores on the following MMPI-2-RF Clinical scales, Demoralization, Low Positive Emotions, and Ideas of Persecution (Pona, Heinberg, Lavery, Ben-Porath, & Rish, 2016). These findings indicate an association with having body image concerns and a history of and/or current depression, as measured by the MMPI-2-RF (Pona et al., 2016).

The MMPI-2-RF has also been utilized as way to identify maladaptive eating behaviors (i.e., binge eating, eating smaller amounts of food over extensive period of time or grazing, uncontrolled eating) and its negative association with weight loss and positive association with psychological distress after bariatric surgery (Marek, Ben-Porath, Merrell, Ashton, Heinberg, 2014). Findings show that higher scores in the MMPI-2-RF internalizing dysfunction domain were positively associated with psychological distress and maladaptive eating behaviors after bariatric surgery. These study results were consistent with the body of literature suggesting that pre-surgical psychopathology continues post surgery, and that the MMPI-2-RF can serve as an ancillary tool with providing information that can assist with identifying potential post-operative outcomes (Marek et al., 2014).

Binge Eating Disorder (BED) is currently a stand-alone diagnosis in the *Diagnostic and Statistical Manual of Mental Disorders* (5^{th} ed., DSM-5; American Psychiatric Association, 2013) and is one of the most common eating disorders, particularly among bariatric surgery candidates, with prevalence rates ranging from 11% to 49% (Coker, Lojewski, Luscombe, & Abraham, 2015). Binge eating can be defined as a loss of control over eating resulting in eating excessive amounts of food in a short period of time. Estimates for individuals who do not meet the full criteria for BED, but who present with symptoms of binge eating, fall within 10% to 69% (Coker et al., 2015). Risk factors associated with binge eating are disordered eating patterns that include dieting and over-eating (Coker et al., 2015).

Nutrition in Bariatrics

Throughout the bariatric evaluation process, most patients are required to meet with a registered dietician or a member of the bariatric surgery team to further understand nutrition and meal planning in order to be successful both pre-operatively and post-operatively. Research indicates that nutrition assessment and education, and dietary management in surgical weight loss are vital components for successful outcomes. According to the American Society for Metabolic and Bariatric Surgery (ASMBS) nutritional guidelines, patients are encouraged to adhere to the diet guidelines after bariatric surgery.

Although meal plans may differ according to the type of bariatric surgery, meal plans are generally structured similarly. During Stage I (two days after surgery), patients (who have no complications from surgery) are typically discharged from the hospital and recommended to consume clear, non-carbonated, non-caffeinated beverages, and to avoid foods that include sugar (Mechanick et al., 2008). Within two to three days post-surgery (Stage II), patients are required to continue drinking clear liquids with no added sugar. A minimum of 48 to 64 ounces of total fluids per day that includes 24 to 32 ounces of clear liquids in addition to 24-32 ounces of any combination of full liquids is recommended.

For instance, consumption of 1% or skim milk with whey or soy protein powder, lactaid milk or soy milk mixed with powder, blended light yogurt, or plain yogurt are viable full liquid options at this stage. In addition, the beginning of supplementation is required. A chewable multivitamin with minerals twice a day, and chewable or liquid calcium citrate with vitamin D is recommended (Mechanick et al., 2008).

Stage III, 10 to 14 days post-surgery, includes an increase in clear liquids to 48 to 64 fluid ounces per day and the replacement of full liquids with soft, moist, diced, ground or pureed protein sources. Patients are advised to plan small meals, chew food thoroughly without drinking beverages simultaneously (Mechanick et al., 2008). At this point, it is recommended that patients use smaller plates and utensils to help with portion control. During the first week of Stage III, patients are instructed to include eggs, ground meats, poultry, soft, moist fish, light mayonnaise to moisten, cooked bean, hearty bean soups, low-fat cottage cheese, low-fat cheese, and yogurt (Mechanick et al., 2008).

During the second week of Stage III or four weeks post-surgery, an advanced diet is encouraged if patients can tolerate protein foods, well-cooked, soft vegetables and soft and/or peeled fruit. It should be noted that protein must be eaten first at every meal (Mechanick et al., 2008). Patients are also advised to drink plenty of liquids to refrain from dehydration during the rapid weight-loss phase. During Stage IV or five weeks post-surgery, patients are instructed to continue to consume protein between 60 to 120 grams daily only when comfortable and to avoid concentrated sweets and high-fat foods to reduce high caloric intake. Patients are allowed to consume solid food and are instructed to include more than five servings of fruits and vegetables daily for optimal fiber consumption, colonic function, and phytochemical consumption (Mechanick et al., 2008).

The continuity of care post-surgery includes monitoring weight loss, managing preexisting medical conditions, and monitoring for surgical and nutritional complications. Providing guidance and support to post-operative patients is important in guaranteeing long-term success. However, it has been noted that patients with disordered eating behaviors, nutritional deficiencies, or other nutritional issues pre-operatively, are likely to have these challenges persist post-operatively (Mechanick et al., 2008). If monitoring is neglected, patients may resume previous eating behaviors and jeopardize their weight loss from bariatric surgery. For instance, patients who choose the vertical sleeve gastrectomy might continue to engage in maladaptive eating behaviors, as sweets and ice cream tend to pass through without difficulty (Mechanick et al., 2008). Patients who choose the adjustable lap band procedure might continue to engage in maladaptive eating behaviors, as they are able to return to their surgeon for band readjustments.

In order to avoid dumping syndrome, and the symptoms associated with it, researchers and bariatric surgeons recommend that a well-balanced diet should include complex carbohydrates, protein, small meals, fiber, while excluding simple sugars (Rusch & Andris, 2007) and avoiding ingestion of liquids within 30 minutes of solid-food intake (Mechanick et al., 2008). Often food intolerance accounts for low protein intake, post-surgery and, therefore, tolerating meat products can be challenging for bariatric patients and therefore, alternative protein sources are recommended. Nevertheless, a deficiency in protein a year after surgery is evident among Post-operative patients (Mechanick et al., 2008).

Sacks and colleagues (2009) found that bariatric patients, who did not follow the recommended diet plan, did not reach the target goal for macronutrients as early as six-months after bariatric surgery. Andreu and colleagues (2010) also examined protein intake among 101 bariatric patients before and after surgery, and found that 45 % and 35% of patients at 4 months and 8 months after surgery consumed less than 60 grams of protein per day. Additionally, studies have found that protein, vitamin B_{12} and folate, iron and calcium are common nutrients affected by bariatric surgery (Alvarez-Leite, 2004). Although protein deficiencies are seen more commonly among RYGB procedures, low incidences have also been observed by the other surgical procedures. Given that there is limited research and no standard postsurgical dietary protocol (Ames, Patel, Ames, & Lynch, 2009), a regular check of protein intake and other macronutrients should be implemented, as it is reported that 5% of patients are hospitalized for the treatment of protein-calorie malnutrition (Alvarez-Leite, 2004).

Diet, Mood, and Weight

The association between mood and diet quality and the impact on weight has several implications for obesity. Perez-Cornago and colleagues (2015) indicate that mood may both affect and be a consequence of a poor quality diet in relation to obesity. Additionally, other studies suggest that low mood and stress are psychological factors that may affect diet quality (Bauer, Hearst, Escoto, Berge, & Neumark-Sztaner, 2012). Taken together, the evidence found here supports the importance of assessing the relationship between diet and mood.

Although findings are mixed, some studies support that diet can serve as a protective factor against mood changes, especially when including macro- and micronutrients such as, selenium, which is typically found in some meats and seafood, iron, zinc, and magnesium (Perez-Cornago, Zulet, & Martinez, 2015). Furthermore, findings suggest that specific diets including, the Mediterranean diet has been found to lower the risk of depression (Sanchez-Villegas & Martinez-Gonzalez, 2013).

The intake of trans fatty acid or food that is high in fat, like fast food or commercially baked products, that are readily accessible outside the home, is likely to contribute to a higher risk of depression (Bauer et al., 2012; Mancino et al., 2009; Sanchez-Villegas, Toldeo, de Irala, Ruiz-Canela, Pla-Vidal, Martinez-Gonazalez, 2011; Sanchez-Villegas & Martinez-Gonzalez, 2013). Although there is the possibility that patients may consume a low nutritional diet at home, research suggests that an overconsumption of energy dense foods outside the home is likely to still compromise diet quality (Mancino et al., 2009). The mediating effects of trans fatty acids serve as a gateway to not only the contribution to weight gain due to worsening of lipid profiles (i.e., increase in low density lipoprotein, decrease in high density lipoprotein), but it also has an impact on depression.

Similar to the relationship between depression and diet, perceived stress and diet may also be a contributing factor on weight and equally as detrimental as depression. Studies indicate that the relationship between stress and obesity occurs through biological and behavioral pathways (Ivezaj & Grilo, 2015). Biologically, neuroendocrine and inflammatory pathways can directly increase fat accumulation, particularly visceral adiposity associated with stress. Additionally, during stress, the brain reward system becomes activated and draws an attraction to palatable foods (i.e., high sugar and fat foods) that lead to subsequent weight gain (Ivezaj & Grilo, 2015).

In the bariatric population, diet quality and mood assessments are pivotal with Post-operative care. Patients are prescribed a pre- and Post-operative diet plan in order to preserve muscle mass, maintain nutritional balance, and promote weight loss. Particularly, patients are recommended to consume a minimum of 60 grams of protein per day and high-quality protein including, lean meat, poultry, fish, low-fat yogurt, eggs, soy products, beans, and lentils (Mechanick et al., 2008). Unfortunately, over time post bariatric surgery diet plans can be bland and monotonous (Miller & Rolls, 1996) and the temptation to consume high-palatable foods (i.e., high fat meat and high sugar items) become a viable option when trying to meet this protein intake goal (Faria, Faria, Buffington, Cardeal, & Ito, 2011).

However, Al-Najim, Docherty, and le Roux (2018) suggest that preferences for high-palatable foods decrease after surgery, particularly with the RYGB and sleeve gastrectomy. Although patients report a decrease in preferences towards chocolate, sweets, and fried food, it is difficult to decipher whether it is a patient's aversion due to changes in taste or a conscious effort to avoid such foods to promote a healthier lifestyle. Nonetheless, another study suggests similar findings in which patients reported 75% less interest in high fat foods 6-months after surgery, although a small sample size was considered to be a study limitation (Coluzzi et al., 2016).

Post-operative Weight Gain

Data suggest that approximately 61% excess weight loss occurs within the first two years after bariatric surgery (Crowley et al., 2012). However, long-term results indicate that estimates of 30% to 50% of patients regain some of the weight lost and approximately 20% of patients will regain the entire initial lost weight (Crowley et al., 2012; Karmali et al., 2013). Post-operative weight gain could be a result of a myriad of factors including psychosocial elements and poor diet.

Several, but not all, studies have found that patients diagnosed with psychological conditions (i.e., depression) are said to be at a greater risk for developing somatic and psychological complications following surgery (Kinzi et al., 2006; Sarwer et al., 2005). However, other studies suggest that there is no influence of a history of psychopathology on weight loss outcome (Sarwer et al., 2005; de Zwaan et al., 2011). Subsequently, studies have yet to come to a consensus on whether pre-operative psychopathology impacts weight loss post-operatively (de Zwaan et al., 2011).

Bariatric diet plans can also be bland and monotonous when patients are recommended to consume non-fat sources of protein and lean meat (Miller & Rolls, 1996) and therefore, high-palatable foods (i.e., high fat meat) become a viable option (Faria, Faria, Buffington, & Ito, 2011) and may contribute to weight re-gain. Furthermore, data suggest that individuals consuming meals outside of the home may increase their food intake, which could contribute to high caloric content and suboptimal weight loss (Kruger et al., 2008).

Study Purpose

The proposed study sought to contribute to the existing research on assessing diet, perceived stress, and mood changes within the first 6-months after bariatric surgery. A 6-month timeframe was specifically chosen, as little is known about the short-term psychological changes in depressed mood and perceived stress as well as the quality of diet in bariatric patients soon after surgery. Although there are recommended nutritional guidelines for bariatric patients, little research has focused on the dietary changes and the patients' ability to sustain them. Furthermore, the relationship between diet, perceived stress, and depressed mood in the bariatric population has yet to be examined more closely given the suboptimal weight losses studies are identifying.

Capturing information from this timeframe during early adjustment after bariatric surgery was meant to provide insight into the factors resulting in weight regain that most studies are identifying after the first year after surgery. By examining level of perceived stress, depressed mood, and diet, this study was intended to contribute to the literature by bringing focus to specific psychological and psychosocial factors that can be easily targeted and addressed in the earlier stages of post-operative care. In doing so, this may prompt bariatric surgical teams to develop and implement tailored, specific preventative strategies in order to deter suboptimal weight loss.

Aims

Aim 1: Mood. Previous research has evaluated the role of psychological factors one year after bariatric surgery, as they relate to weight loss and weight loss maintenance. However, there has been very little focus on psychological factors within the first 6-months after surgery. Research shows that the majority of bariatric patients experience less negative mood and a decrease in level of stress after surgery. Hypothesis 1a and 1b assesses changes at Time 1 (pre-surgical visit) and Time 2 (six-months after surgery).

Hypothesis 1a. It was predicted that patients would report a decrease in perceived stress between Time 1 and Time 2.

Hypothesis 1b. It was predicted that patients would report a decrease in symptoms related to a depressed mood between Time 1 and Time 2.

Aim 2: Fat intake. In order to preserve muscle mass, maintain nutritional balance, and promote weight loss, it is recommended that bariatric patients consume a minimum of 60 grams of protein per day (Mechanick, 2008). Some sources of high-quality protein include lean meat, poultry, fish, low-fat yogurt, eggs, soy products, beans, and lentils (Mechanick et al., 2008). Unfortunately, over time diet plans can be bland and monotonous (Miller & Rolls, 1996), and the temptation to consume high-palatable foods (i.e., high fat meat) become a viable option to patients when trying to meet this protein intake goal after surgery (Faria et al., 2011). However, consumption of high fat meat decreases attempts at successful weight loss. The second aim examined the frequency of high-fat meat (that will be operationalized by the Eating and Diet Questionnaire and Dietary Fat Screener) at the baseline visit (Time 1) and the 6-month visit (Time 2). Given the poor reliability of the Eating and Diet Questionnaire (explained further in Chapter II), this hypothesis was modified (see below).

Hypothesis 2. Eating high-fat meat at a higher frequency than those who consume lower-fat forms of protein at Time 2 will experience a lower percent weight loss at Time 2.

Modified hypothesis 2. It was predicted that percentage weight loss at Time 2 would be high due to the change of consumption of lower-fat high-fat forms of protein on a measure of dietary fat between Time 1 and Time 2.

Aim 3: Stress and depressed mood and meals. Research suggests that low mood and stress are psychological factors that might affect the quality of a patient's diet (Bauer et al., 2012). And, when individuals experience a higher level of stress and/or lower negative mood, the consumption of "ready to eat foods" or eating food that is readily available outside the home is common and likely to be unhealthy options (Bauer et al, 2012; Mancino et al., 2009). Research has found that consuming food away from home is a contributing factor to the quality of a patient's diet (Mancino et al., 2009). One could argue that patients may consume lower nutritional quality foods when eating at home; however, research indicates that there is an overconsumption of energy dense foods outside the home, which comprises the quality of one's diet after surgery which consequently impacts weight (Mancino et al., 2009). The third aim focused on association between stress and mood, and the frequency of consuming prepared meals at home. This hypothesis was also modified due to the poor reliability of the measure, Eating and Diet Questionnaire.

Hypothesis 3a. Bariatric patients with a higher perceived stress at Time 1 will report a lower frequency of consuming prepared meals at home at Time 1.

Hypothesis 3b. Bariatric patients with a higher perceived stress at Time 2 will report a lower frequency of consuming prepared meals at home at Time 2.

Hypothesis 3c. Bariatric patients with a higher level of depressed mood at Time 1 will report a lower frequency of consuming prepared meals at home at Time 1.

Hypothesis 3d. Bariatric patients with a higher level of depressed mood at Time 2 will report a lower frequency of consuming prepared meals at home at Time 2.

Modified hypothesis 3. Change in level of perceived stress, change in healthy eating, and change in depressed mood was examined over time (Time 1 and Time 2).

Aim 4: Mediation. The fourth aim examined whether diet at Time 2 mediates the relationship between perceived stress/depressed mood at Time 2 and percent weight loss at Time 2. The purpose of this aim was to determine whether diet, specifically a healthy diet explains the relationship between perceived stress and depressed mood and weight outcome at Time 2.

Hypothesis 4a. A healthy diet would mediate the relationship between perceived stress and weight, as measured at Time 2.

Hypothesis 4b. A healthy diet would mediate the relationship between depressed mood and weight at Time 2.

CHAPTER II

METHOD

Participants

The present study included 80 patients who were enrolled in the bariatric program at Sentara Comprehensive Weight Loss Solutions. Initially, another 46 participants were recruited but were then lost to follow-up due to a temporary hold on recruitment per the request of the Virginia Consortium Program in Clinical Psychology.

Sample size was determined through an *a priori* power analysis using the computer program G*Power, v.3.1 (Faul, Erdfelder, Lang, & Buchner, 2007), using an alpha value of .05, a power value of .80, and a partial R^2 effect size of .30. An *a priori* power analysis suggested a recruitment of 89 patients to achieve sufficient statistical power. However, 100 patients were recruited to account for attrition when study recruitment re-started in 2017. Participants were recruited at baseline (i.e., pre-surgical visit or Time 1) and were seen for a follow-up 6-month post-operative visit (i.e., Time 2).

Patients who attended the pre-operative education classes and completed the compulsory psychological evaluation prior to approval for bariatric surgery were eligible to participate in the current study. Additionally, the present study recruited patients who were seeking the vertical sleeve gastrectomy and RYGB as the bariatric surgeons at Sentara Comprehensive Weight Loss Solutions only perform these two bariatric procedures (S. Wohlgemuth, personal communication, October, 2016). Given that surgical staff confirmed that these two surgeries are performed, surgery type information was not collected.

Exclusion criteria. Patients under 25 or over 60 years old, pregnant, had an uncontrolled psychiatric illness, and/or were returning for a revisional bariatric surgery, were excluded from the study.

Design and Procedure

This study used a repeated measures design to examine the level of stress, depressed mood, and type of dietary intake at a patient's pre-surgical (Time 1) and 6-months postsurgical visit (Time 2). Data was collected from recruited patients at Sentara Comprehensive Weight Loss Solutions. Patients were requested to attend a pre-operative seminar, complete a psychological pre-surgical evaluation with a licensed clinical psychologist, and meet with a dietitian prior to their routine history and physical visit with the nurse practitioner, which is scheduled typically scheduled one to two weeks prior to surgery date. Institutional Review Board (IRB) approval was granted through the Eastern Virginia Medical School (IRB # 16-EX-0027) on February 25, 2016.

Patients who were attending their pre-surgical visit were instructed by front desk administrative staff to meet with the author of the present study or graduate research assistant to inform them of the present study. Upon obtaining consent, each participant who was attending his or her routine History and Physical visit (i.e., pre-surgical visit) with the nurse practitioner met with either the author of the present study or a graduate research assistant. Of note, patients were informed that their involvement was voluntary and that no penalty would incur if they did not wish to partake in the study. The consenting process entailed a review of the study and study measures.

Patients were provided a protein guideline sheet and were administered pencil and paper versions of a demographic questionnaire, PHQ-9, PSS-10, Dietary Fat screener, Fruit-Vegetable-Fiber screener, and the Eating and Diet Questionnaire. Study measures were not counterbalanced, purely an accidental oversight by the author of the present study. Patients who were not able to complete the study measures before meeting with the nurse practitioner were allowed to finish the paperwork after their visit. Weights were recorded when medical assistants weighed patients before the patient had their meeting with the nurse practitioner. The main researcher or a graduate research assistant assisted the front desk administrative staff with scheduling each patient's 6-month postsurgical visit. With permission from the patient, patients were contacted to remind them of their six-month follow-up visit.

A day before a patient's 6-month postsurgical visit, they were reminded of their appointment and that they would be asked to re-complete measures for study. Patients typically arrived 10 to 15 minutes before their scheduled appointment time to complete testing measures. The main researcher or a graduate research assistant presented measures after the patient checked-in with front desk administrative staff. Similar to their pre-surgical visit, patients were provided a protein guideline sheet and were administered pencil and paper versions of a demographic questionnaire, PHQ-9, PSS-10, Dietary Fat screener, Fruit-Vegetable-Fiber screener, and the Eating and Diet Questionnaire. Subsequently, weights were collected once medical assistants weighed patients.

Measures

Demographics. After obtaining consent, patients provided demographic information, including age, gender, race/ethnicity, marital status, BMI, employment status, height, weight, and level of education. Patients were also asked to identify the type of visit (i.e., Time 1 or Time 2) they were attending (See Appendix A).

Protein Guideline Sheet. A protein guideline sheet that was adapted from the Move! Weight Management Program supported by the U.S. Department of Veterans Affairs' National Center for Health Promotion and Disease Prevention (MOVE! Weight Management Program, 2012) and ASMBS nutritional guidelines (Aills, Blankenship, Buffinton, Furtado, & Parrott, 2008) was provided to patients at both Time 1 and Time 2, as a guideline for identifying and measuring protein intake (see Appendix B).

Eating and Diet Questionnaire. The Eating and Diet Questionnaire was provided to patients and assessed diet including eating patterns, protein intake, how often meals are consumed in a week, and location of consuming meals (i.e., home or restaurant). This two page; 10-item questionnaire that was created by the author of this study, was administered at Time 1 and Time 2. The questionnaire-required patients to circle the best answer or complete the comment section if the given response choices did not accurately represent their answer. Responses were measured based on frequencies. For example, item 2 asks to identify how often the individual is cooking and preparing meals (from basic ingredients in a week). Responses range from 0 (*no meals per week*) or +21 (*over 21 meals per week*). The Eating and Diet Questionnaire indicated an unacceptable internal reliability (Cronbach's $\alpha = .22$). Item analysis was also conducted to determine if items were internally consistent. Each of the 10 items on the Eating and Diet measure tested at an unacceptable internal consistency (ranging from Cronbach's $\alpha = .005$ to $.394$). The five items on prepared meals tested at an unacceptable internal consistency ($\alpha = .28$). When item 10 consumption of protein in a week was removed from the Eating and Diet Questionnaire, the scale produced a Cronbach's α of .394 (See Appendix C).

Healthy Diet Questionnaire. This measure was developed due to the poor reliability from the Eating and Diet Questionnaire and was utilized for Aim 3. Items on the Healthy Diet measure included reversed items from the Block Dietary Fat Screener which included hamburgers, fried chicken, bacon or breakfast sausage, salad dressings (not low-fat), margarine, butter or mayo on bread or potatoes, eggs (not egg beaters or just egg whites), pizza, whole milk, French fries or fried potatoes, corn chips, doughnuts (or pastries, cake, cookies; not low-fat), and ice cream. Addition to the reversed items, the Healthy Diet measure included the following items: fruit (fresh or canned), green salad, vegetable soup or stew with vegetables, other vegetables (e.g., string beans, peas, corn, broccoli), and dark bread (e.g., whole wheat or rye) from the Block Dietary Fruit-Vegetable-Fiber Screener. In the present study, the Healthy Diet Questionnaire was found to have acceptable internal reliability (Cronbach's $\alpha = .70$).

Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 is a nine-item self-report questionnaire designed for screening for depression in clinical settings. The PHQ-9 also assesses the severity of depressive symptoms (Kroenke, Spitzer, & Williams, 2001). Responses were measured on a four point item scale that ranges from 0 (*Not at all*) to 3 (*Nearly everyday*). PHQ-9 includes items that address components of DSM-V (APA, 2013) criteria for depressed mood in the last two weeks. Specifically, items 1 and 2 assess anhedonia and mood, while item 9 corresponds to suicidal ideation. If a score of at least a 5 on questions 1 and 2, total score above 15, or 1, 2, or 3 for question 9 were endorsed patients were referred to the on-site clinical psychologist. If additional treatment was warranted, patients were scheduled for additional psychological support. PHQ-9 scores range from 0 to 27 with recommended cut-off scores at 5 for mild, 10 for moderate, 15 for moderately severe, and 20 for severe depressive symptoms (Cassin et al., 2013). The present study used PHQ-9 total sum scores. The study did not use a cut-off to identify different levels of depression. However, Cassin and colleagues (2013) showed that the PHQ-9 was found to be an acceptable depression screening measure for the bariatric population (Cassin et al., 2013). Additionally, Cassin and colleagues (2013) found that a PHQ-9 cut-off of 15 was considered to be the guideline for identifying bariatric surgery candidates for further assessment of depressive symptoms (Cassin et al., 2013).

The PHQ-9 was chosen due to its strong construct validity and strong internal reliability in medical populations (Marek et al., 2016). For instance, Monahan and colleagues (2007) tested the validity and reliability of the PHQ-9 among adults living with HIV/AIDS in Western Kenya. Results showed a Cronbach's alpha of .78 at baseline and one-week test-retest reliability of PHQ-9 total score of .59. Another study by Hammash and colleagues (2012) examined the psychometric properties of the PHQ-9 as a measure of depressive symptoms in patients with heart failure. The study found item-total correlations ranging between .44 and .68 and internal consistency reliability ranging between .86 and .89 (Hammash et al., 2012; See Appendix D).

Cohen's Perceived Stress Questionnaire (PSS-10). The Perceived Stress Questionnaire is a measure assessing psychological stress within a month time frame. The original or standard version includes a 14-item scale that was developed by Cohen and colleagues in 1983, but was shortened to a 10-item scale from factor analysis that was based on data from 2,387 U.S. residents (Lee, 2012). The present study measured perceived stress with the shortened version with 10-items assessing for psychological stress (PSS-10). The PSS-10 was used in the present study given its short length, and more importantly, for its acceptable psychometric properties.

The PSS-10 is a 10-item, self-report measure that assesses the degree of perceived stress in certain situations an individual is experiencing in the past month (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Janicki-Deverts, 2012). Responses were measured on a 5-point scale ranging from 0 (*never*) to 4 (*very often*). Items 4, 5, 7, and 8 required reverse coding, for example, 0=4, 1=3, 2=2, and 4=0. Responses to the 10 items created a total sum psychological stress score, with higher scores indicating greater psychological stress. Lee (2012) examined the psychometric properties of the PSS-10 from 12 studies. The studies that used the PSS-10 were tested in diverse populations including with university students, in medical health settings, and in the police force (Lee, 2012). From the 12 studies, Lee (2012) found that the PSS-10 tested internal consistency reliability at a Cronbach's alpha > .70 (Lee, 2012). Internal reliabilities of the PSS-10 have a Cronbach's alpha ranging from .78 to .91. Criterion validity was also established and was strongly correlated ($r > .70$) to the standard version of the PSS (Lee, 2012). The present study found the PSS-10 to have a Cronbach's alpha at .70, acceptable internal reliability (See Appendix E).

Block Dietary Fat and Fruit-Vegetable-Fiber Screeners. Both the Block Fat and Fruit-Vegetable-Fiber screeners are brief one-page self-administered assessments. Responses on the Dietary Fat Screener were measured on a 5-point Likert scale ranging from 0 (*1/month*) to 4 (*5+ times a week*). Responses on the Dietary Fruit-Vegetable-Fiber Screener were measured on a 6-point scale ranging from 0 (*Less than 1/week*) to 5 (*2+ a day*). Responses from the Block Dietary Fat and Block Fruit-Vegetable-Fiber screeners each had their own total sum score (Appendices F and G).

In a previous study both screeners were compared to the 1995 Block 100-item Food Frequency Questionnaire (Block, Clifford, Naughton, Henderson, & McAdams,

1989) and found to have comparable psychometric properties (Block, Gillespie, Rosenbaum, & Jenson, 2012). The screeners effectively assess for the essential sources of nutrients that are in the American diet. The authors of the screeners tested Spearman rank-order correlation coefficient for the Dietary Fat screener is $r > .60$ and for the Dietary Fruits, Vegetables, and Fiber Screener is $r > .71$ (Block et al., 2012). In the present study, the Block Dietary Fat screener tested at a Cronbach's alpha of .80, acceptable internal reliability and the Block Fruit-Vegetable-Fiber screener tested a Cronbach's alpha at .82 with good internal reliability. Additionally, five high-fat items from the Block Dietary Fat screener, hamburgers, beef, fried chicken, hotdogs, and bacon were tested for the modified Aim 2. Although still lower than preferred, the five items tested at a Cronbach's $\alpha = .50$.

Statistical Analysis

Data were analyzed using IBM *SPSS Statistics version 25* for Macintosh and the last aim tested a mediation model using path analysis in Mplus (Muthén & Muthén, 2007).

The first aim was tested with paired samples *t*-test to determine if patients reported a decrease in perceived stress and depression between Time 1 and Time 2. A regression analyses tested the initial second aim, which examined eating high-fat meat at a higher frequency than those who consumed lower-fat forms of protein at Time 2 will experience a lower percent weight loss at Time 2. The modified second aim examined the frequency of high-fat meat by paired sample *t*-tests to determine if percent weight loss at Time 2 would be associated with the consumption of high-fat meat between Time 1 and Time 2. This aim was modified due to the poor internal reliability from the Eating and Diet Questionnaire and second, to determine the change of consumption of food, particularly with meat consumption, given that studies indicate greater weight loss with adhering to the bariatric dietary guidelines (Mitchell et al., 2016). Inadequate protein and dietary adherence is a concern following bariatric surgery (Mitchell et al., 2016; Moize et al., 2003). As such, examining change in meat consumption between Time 1 and Time 2 would provide a more accurate depiction of dietary adherence compared to the proposed initial Aim 2.

The third aim examined the association of level of stress and depressed mood in relation to consuming prepared meals at home. This initial aim was tested with regression analyses. However, after assessing the internal reliability statistic of the five prepared meal items from the Eating and Diet Questionnaire unacceptable internal consistency was discovered of the prepared meal items. Therefore, conducting this analysis would not have been constructive and the predicted hypotheses could not be addressed. However, change in stress, change of healthy eating, and change in depressed mood were examined over time. Thus, the research question was modified to determine if improvements in a healthy diet occurred between Times 1 and 2, and then whether changes in perceived stress or depression was associated with changes in a healthy diet at both Times 1 and 2. Aim 3 hypotheses were tested with a Pearson correlation. Lastly, Aim 4 was tested in Mplus with mediation path analysis (MacKinnon, Fairchild, & Fritz, 2007) to determine whether changes in perceived stress was related to percent weight loss through changes with a healthy diet (Hypothesis 4a). Hypothesis 4b was tested to determine if depressed mood is related to percent weight loss through changes with a healthy diet.

CHAPTER III

RESULTS

Demographics

A total of 101 patients were recruited, 8 patients were considered screen fails due to age criteria, smoking history, and not meeting the recommended pre-operative weight goal. Of the remaining 93 patients, 80 completed both visits and 13 patients did not return for their 6-month follow-up visit. In the data set, the majority of patients (87.1%) were female (male patients, 12.9%), which is consistent with Young and colleagues (2016) who have found that the percentage of females seeking bariatric surgery is larger in comparison to males. Total sample included a majority of patients were either Caucasian (58.1%) or African American (29.0%). Further, total sample of 93 included a majority of married patients (58.1%); 28.0% were single; 9.7% were divorced; 2.2% widowed; and 2.2% were in a marriage like relationship. A significant majority of patients (82.8%) were employed; 8.6% were disabled; 5.4% were unemployed; 1.1% were retired; and 1.1% identified as homemaker (See Table 1 for more demographic information). Surgery type was not collected, as the surgical staff confirmed that vertical sleeve gastrectomy is typically the procedure that is performed more routinely than gastric bypass procedures at this clinic (S. Wohlgemuth, personal communication, October, 2016). Patients who completed both visits at Time 1 and Time 2 (n = 80) were compared to patients who did not return for their visit at Time 2. Results indicate statistically significant lower pre-operative BMI of completers in comparison to non-completers. See Table 2.

Table 1

Demographic Characteristics.

Characteristics	*n*	%
Age		
25-33	18	19.4
34-42	28	30.1
43-51	27	29.0
52-60	18	19.4
Gender		
Male	12	12.9
Female	81	87.1
Marital Status		
Never married/Single	26	28.0
Married	54	58.1
Divorced/Separated	9	9.7
Widowed	2	2.2
Marriage-Like Status	2	2.2
Race		
Caucasian/White	54	58.1
African American/Black	27	29.0
Hispanic	4	4.3
Asian	2	2.2
Biracial	4	4.3
Other	2	2.2
Employment		
Unemployed	5	5.4
Retired	1	1.1
Homemaker	1	1.1
Employed	77	82.8
Disabled	8	8.6
Other	1	1.1
Education		
Less than 12	4	4.3
High School Diploma	16	17.2
Trade/Vocational/Associate's	33	35.5
Bachelor's	23	24.7
Post-Bachelorette	17	18.3

Note. Total sample included both completers and non-completers.

Table 2

Completers versus Non-completers.

	t(df)	Completers[a] *M (SD)*	Non-Completers[b] *M (SD)*	*p*
Age	-.48 (92)	42.59 (9.41)	41.23 (10.18)	.64
BMI	3.08 (92)	46.25 (6.41)	52. 42 (8.40)	.003
	X^2(df)	Completers[a]	Non-Completers[b]	*p*
Gender	.37 (1)			.54
Women n (%)		68 (86.3%)	12 (92.3%)	.472
Race	4.29 (5)			.51
White n (%)		47 (58.8%)	7 (53.8%)	.51

Note. Percentage in parentheses and standard deviation in parentheses, [a]*n* =80, [b]*n* = 13.

Pre- and Post-operative Measure Scores

Pre- and post-operative measures indicate that patients reported changes on the PHQ-9, PSS-10, Block Dietary Fruit-Vegetable-Fiber screener, and Block Fat screener. See Table 2 for information regarding pre- and post-operative measure scores.

Table 3

Pre-operative and 6-months Post-operative Measures.

Measures (n= 80)	t(df)	Pre-Op *M (SD)*	Post-Op *M (SD)*	p
PHQ-9	5.39 (79)	4.46 (3.84)	2.00 (3.52)	< .001
PSS-10	1.84 (79)	10.20 (5.30)	11.42 (5.76)	.08
Fruit-Veg-Fiber	3.21 (79)	10.29 (3.60)	8.36 (4.82)	.002
Fat	6.79 (79)	20.73 (8.34)	14.50 (6.88)	.001

Note. Standard deviation in parentheses. PHQ-9 = Patient Health Questionnaire – 9 items. PSS-10 = Perceived Stress Scale – 10. Fruit-Veg-Fiber = Block Fruit-Vegetable-Fiber Screener. Fat = Block Fat Screener. The Eating and Diet Questionnaire was not included due to not having a total calculated score.

Weight Loss

Mean BMI at patients' pre-operative visit was 46.25 (*SD* = 6.41) and mean BMI at 6-month post-operative visit was 34.59 (*SD* = 5.65). Percent weight loss was calculated and was 24.77 (*SD* = 5.95).

Table 4

Mean Participant Weight and BMI by Pre-operative and Post-operative Visits.

	Weight *M (SD)*	BMI *M (SD)*	%WL
Pre-Op (*n* = 80)	282.21 (47.03)	46.25 (6.41)	
Post-Op (*n* = 80)	212.09 (37.75)	34.59 (5.65)	24.77 (5.95)*

Note. Standard deviation in parentheses BMI = body mass index; %WL = percent weight loss, * $p < .001$.

Aim 1: Mood

Paired samples *t*-tests examined whether patients reported a decrease in perceived stress and depression between Time 1 and Time 2. Results indicated that there was a statistically significant decrease in depression between Time 1 and Time 2 (*M change*=2.45, *SD* = 4.07), paired $t(79) = 5.39$, $p <.001$, $d = 0.60$. However, the change in perceived stress was not statistically different (*M change* = 1.29, *SD* = 6.25), paired $t(79) = 1.84$, $p=.069$, $d = 0.21$, although the effect was in the hypothesized direction and was approaching significance. See Figure 1.

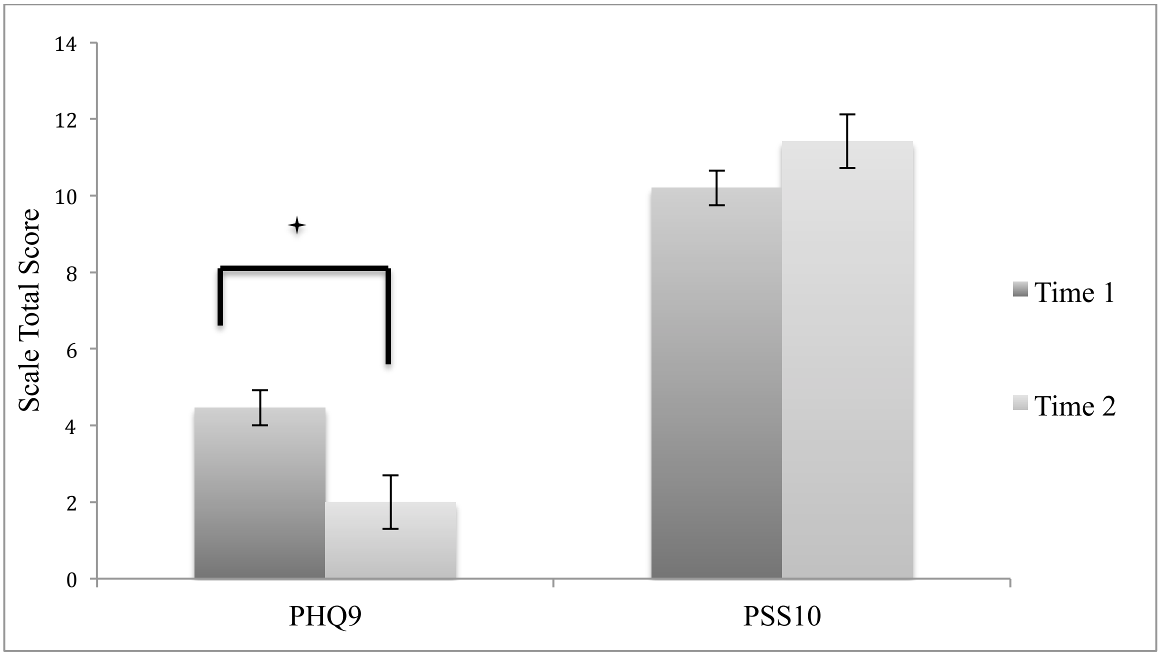

Figure 1. PHQ-9 and PSS-10 Pre- and Post-op Mean Change Scores.

Note.✦ $p < .001$

Aim 2: Fat Intake

Results from the initial hypothesis indicated that eating high-fat meat at a higher frequency did not experience a lower percent weight loss at Time 2, $R^2 = .035$, $F(2, 79) = 1.40$, $p = .253$. Prior to data analysis, the reliability of the Block Dietary Fat Screener was tested and had acceptable global reliability (Cronbach's α = 0.75). Despite its reliability, the researchers came to the conclusion that as a measure it captures a broader set of behaviors than what is being examined in the present study. To better address the present study's hypothesis of high fat meat consumption and its association with weight outcome at Time 2, five high fat items from the Block Dietary Fat screener were identified for the modified hypothesis. Consequently, the scale means of relevant fat items including, Ham, Beef, Fried Chicken, Hotdogs, and Bacon were identified as high fat items and were instead used with a Cronbach's alpha of .51 (although still lower than preferred).

The modified hypothesis proposed that percentage of weight loss at Time 2 would be high due to the change of consumption of high-fat meat at Time 2. Paired sample *t*-tests showed statistically significant decreases for both changes in weight in pounds (*M change*= 70.01, *SD* = 21.40), paired $t(78)= 29.07$, $p< .001$, $d = 3.27$), see Figure 2 and high fat scores (*M change*= 1.39, *SD* = 2.96), paired $t(78)= 4.18$, $p <0.001$, $d = 0.47$), see Figure 3.

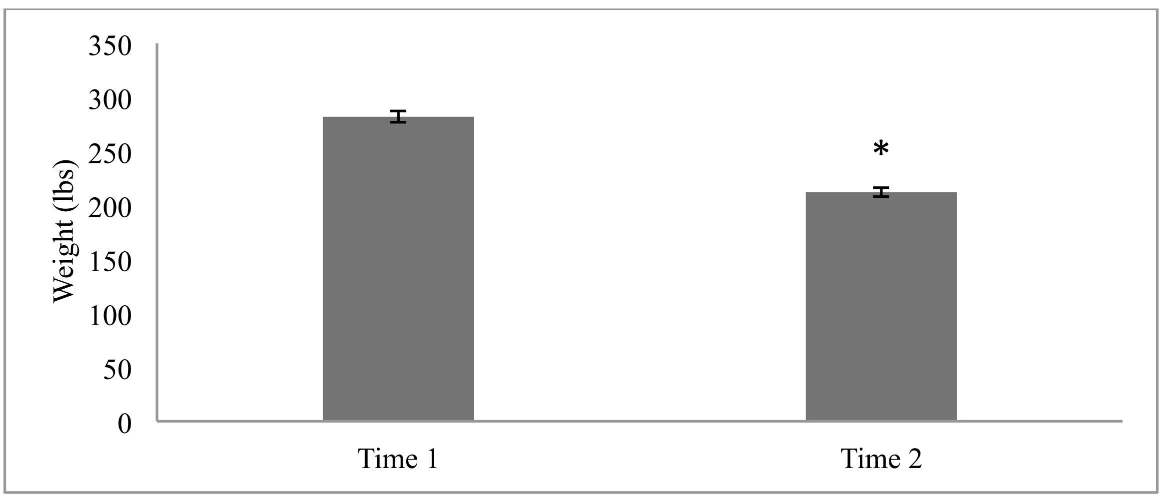

Figure 2. Weight Loss Change.

Note. * $p < .001$

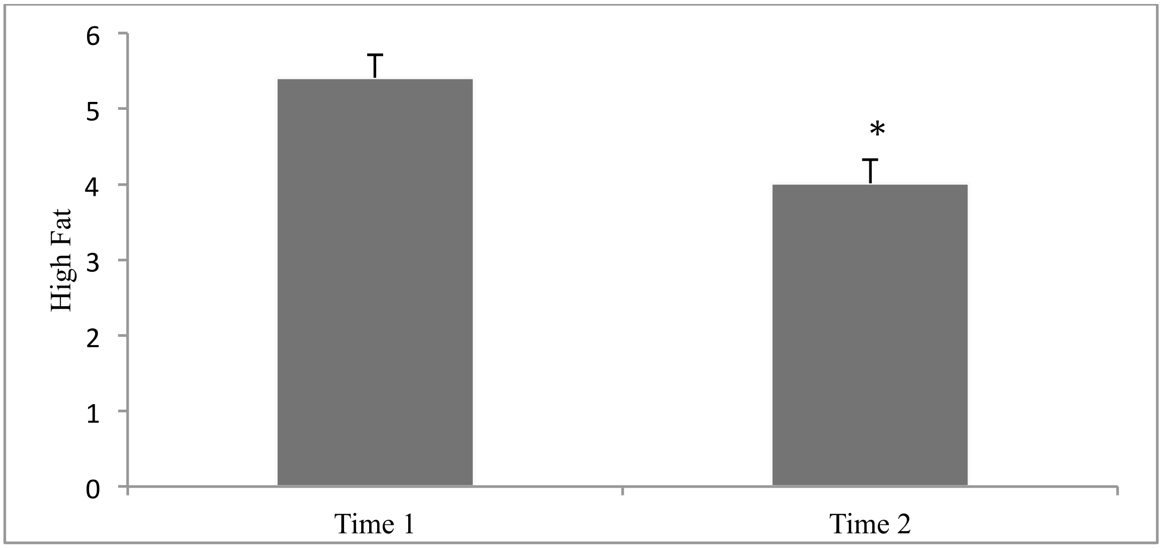

Figure 3. High-Fat Meat Change.

Note. * p < .001

To test the primary hypothesis, a percent weight loss variable (M = 24.71, SD = 5.97) was created to control for baseline weight; however, this variable was not significantly associated with change in high-fat meat, Pearson r (79) = .13, p = .244. Similarly, after controlling for age, gender, and initial weight in pounds, there were no statistically significant associations between any of the predictors (including change in consumption of high-fat meat) with percent weight loss, Pearson r (79) = .096, p = .873; with consumption of high-fat meat, Pearson r (79) = .16, p = .295.

Aim 3: Stress and Depressed Mood and Meals

It was initially proposed that a regression analysis would be conducted to determine if high perceived stress at Time 1 would be associated with consuming prepared meals at home at Time 1. Regression analyses were tested for each of the sub-hypotheses for Aim 3, which found that there were no significant in relationships with levels of perceived stress and with consuming prepared meals (Hypothesis 3a, hypothesis 3b) as well as with levels depressed mood and with consuming prepared meals (Hypothesis 3c, hypothesis 3d), see Table 5.

Table 5

Initial Aim 3 Results On Prepared Meals.

	F (df)	*p*
H3a	1.17 (2, 79)	.317
H3b	.019 (2, 79)	.981
H3c	.40 (2, 79)	.714
H3d	.94 (2, 79)	.395

Note. H3a and H3b examined level of perceived stress and consuming prepared meals at home at Time 1 and Time 2, H3c and H3d examined level of depressed mood and consuming prepared meals at home at Time 1 and Time 2.

Given the unacceptable internal consistency (α = .28) of the prepared meal items, planned analysis was not constructive. However, change in stress, change of healthy eating, and change in depressed mood was examined over time. A Healthy Eating Questionnaire was constructed out of the reversed Block Dietary Fat Screener including items: hamburgers, fried chicken, bacon or breakfast sausage, salad dressings (not low-fat), margarine, butter or mayo on bread or potatoes, eggs (not egg beaters or just egg whites), pizza, whole milk, French fries or fried potatoes, corn chips, doughnuts (or pastries, cake, cookies; not low-fat), and ice cream, in order to address change of healthy eating for bariatric patients. In addition to the aforementioned reversed items, the Healthy Eating Questionnaire included items from the Dietary Fruit-Vegetable-Fiber Screener: fruit (fresh or canned), green salad, vegetable soup or stew with vegetables, other vegetables (e.g., string beans, peas, corn, broccoli), and dark bread (e.g., whole wheat or rye). The Healthy Diet Questionnaire indicated acceptable internal reliability with the 18 items: Cronbach's $\alpha = 0.70$. See Figure 4.

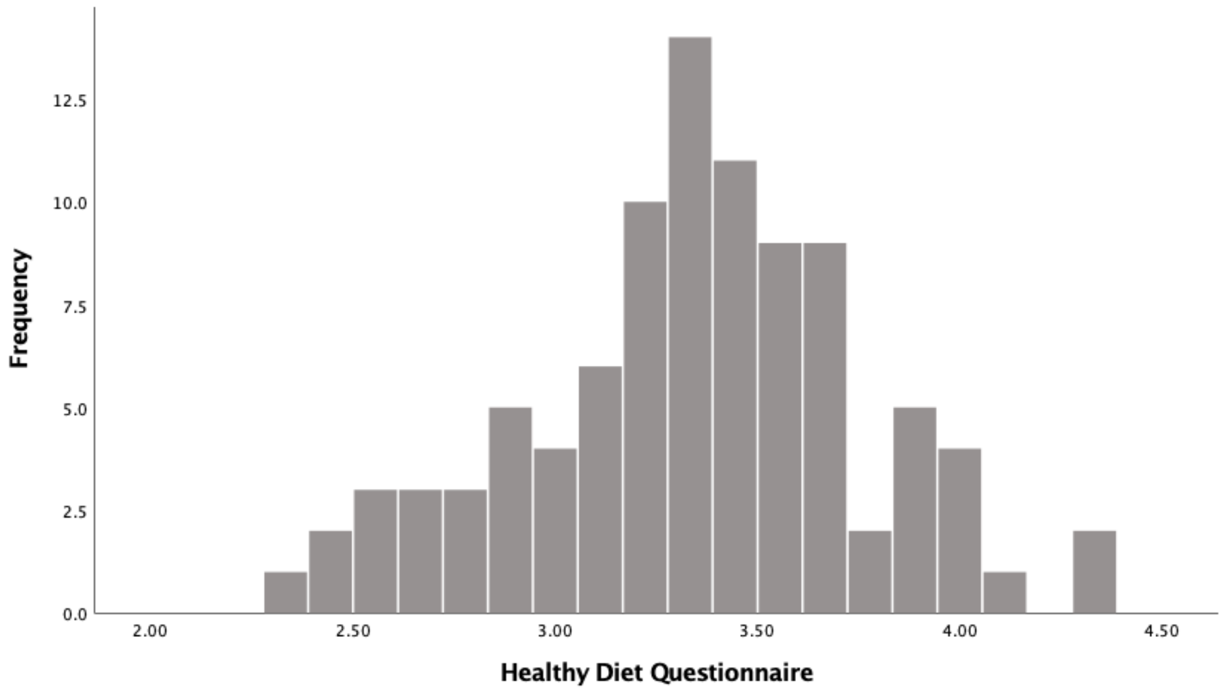

Figure 4. Distribution of Items from Healthy Eating Questionnaire.

Consequently, the research question was modified to determine if improvements in diet occurred between Times 1 and 2, and then whether changes in perceived stress or depression would be associated with healthy diet at both Times 1 and 2 and changes in healthy diet. A statistically significant improvement was found in healthy diet (*M change* = 0.23, *SD* = 0.45), paired $t(78) = -4.52$, $p < .001$, $d = 0.51$).

Results for the relationship between change in perceived stress and healthy eating at Time 1 was significantly negatively correlated, Pearson $r = -.22$, $p = .049$, but not significant at Time 2, Pearson $r = -.10$, $p = .389$ or with changes in healthy diet, Pearson $r = .14$, $p = .214$. The negative correlation between changes in depressed mood and healthy eating at Time 1 was significant, Pearson r = -.28, p = .012 but not at Time 2, Pearson r = -.11, p = .355, or with changes in healthy diet, Pearson r = .19, p = .09, d = .50, 95% CI [-0.03, 0.05]. Results indicate that patients with the worst eating habits at Time 1 were associated with greater reductions in perceived stress and depressed mood.

Aim 4: Mediation Relationship

Initially, it was hypothesized that a healthy diet would mediate the relationship between stress and percent weight loss, as well as mediate the relationship between depressed mood and percent weight loss. However, an examination of the hypothesized associations did not support this mediation hypothesis. Percent weight loss was not statistically significantly associated with changes in stress, Pearson r = .13, p = .252, or with changes in depression, Pearson r = -.08, p = .494, although it was associated with healthy diet changes, Pearson r = .27, p = .015.

Given the bivariate association between weight loss with changes in healthy diet, and changes in healthy diet was approaching significance with changes in depression (p = .09), a mediation path analysis was conducted in the statistical program, Mplus, to explore the indirect effects particularly with changes depression. See Figure 5 for the direct effects.

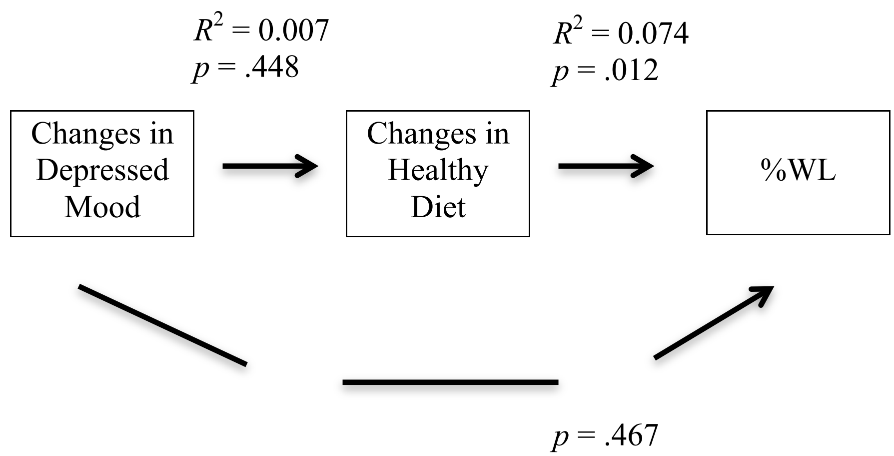

Figure 5. Changes in Depressed Mood and Healthy Diet on Percent Weight Loss.

The path analysis was conducted and results indicated that there was no indirect or direct effect between depressed mood and healthy diet. However, there was a significant direct effect between changes in healthy diet and percent weight loss. Schumacker & Lomax (2004) and Kline (1998) suggest testing one absolute fit index and one incremental fit index when determining model fit. The following were used as a way to determine acceptable ranges for the indices: a value close to .05 or .08 for Root-mean-square-error of approximation (RMSEA) indicates a close fit, values close to .90 or .95 reflect a good fit for Comparative Fit Index (CFI), values close to .90 or .95 reflect a good model fit for Tucker-Lewis Index (TLI), and value less than .05 indicates a good model fit for Standardized Root-mean square residual (SRSR; Schumacker & Lomax, 2004).

Model fit was generally satisfactory, but less so when considering penalties for parsimony, X^2 (df = 1, N = 80) = 1.37, p = .24. RMSEA = 0.07, 95% CI [0.00, 0.32]. CFI = 0.93, TLI = 0.78, SRMR = 0.05, $p < .05$. The present model unfortunately did not include a great amount of parameters needed to explain the model with accuracy. As a result, if more parameters were included, the model may have had a good fit (Schumacker, 2004; Kline, 1998).

CHAPTER IV

DISCUSSION

The present study sought to contribute to the existing body of research and expand upon current understanding of the relationship among mood, stress, and diet in the bariatric population. In particular, this study utilized measures that addressed dietary consumption and depressed mood and perceived stress both pre- and 6-months post bariatric surgery to determine if diet, specifically a healthy diet, mediates the relationship between depressed mood and perceived stress and weight loss outcome. Furthermore, the present study contributes to the literature by the utilization of a brief depression and perceived stress measure implemented in a medical clinical setting among bariatric patients. In sum, study findings, discussed below, demonstrated few consistencies with the literature and were unique to the present study.

Mood

It was hypothesized that patients would report a decrease in symptoms related to depressed mood from their pre- and 6-month postsurgical visit. Consistent with previous literature, this study showed pre- and post-operative changes in depressed mood, as measured by the PHQ-9. Mood is an important component to consider in the bariatric population, as studies indicate a high prevalence of depression in pre-surgical candidates (de Zwaan et al., 2011; Blaine, 2008) and thus, several studies have examined depression in bariatric patients.

For example, a meta-analysis by Dawes et al. (2016) found that within seven studies, the prevalence of depression was found to decrease (8%-74%) and six studies showed a decrease in the severity of depressive symptoms (40-70%) 6 to 24 months post bariatric surgery. However, other studies, similar to that of Mitchell and colleagues

(2014), show an increase in depressed mood after 12 months post surgery. Possible reasons could be due to patients' disappointment of having unrealistic expectations about bariatric surgery, weight regain, reoccurrence of comorbidities, in addition to various limitations in study methodologies (Mitchell et al., 2014). Despite these contradictory findings regarding mood changes as it relates to bariatric surgery, the present study supports the body of literature on the improvement of depressed mood post bariatric surgery.

The present study also contributes to the literature given the utility the PHQ-9 depression measure among the bariatric population. Several studies have already found that the Beck Depression Inventory (BDI-II), a widely used depression-screening instrument measure that requires a fee, can be used reliably and validly in the bariatric population (Schutt, Kung, Clark, Koball, & Grothe, 2016). In contrast, the PHQ-9 has not been studied as frequently. The PHQ-9 has several advantages over the BDI-II, as it is a no cost depression assessment instrument, briefer, and a well-known measure in medical settings (Schutt et al., 2016). Therefore, medical providers (i.e., physicians, nurses) may want to use the PHQ-9, as it is an acceptable depression screener due to its practicality and familiarity (Schutt, et al., 2016).

Perceived Stress

Studies have found a relationship between the amount of stress individuals experience and higher BMI (Sinha & Jastreboff, 2013). This relationship could partly be due to stress-related behaviors that include, meal skipping, binge eating, snacking, and/or eating calorie-dense, palatable foods (Sinha & Jastreboff, 2013). For instance, Boniecka et al. (2017) surveyed 50 bariatric patients assessing the link between stress scores from the Cohen's Perceived Stress questionnaire (PSS-10) and eating behaviors from patients' pre-surgical to post-operative visits. Results indicated that 60% reported that eating additional snacks helped with reducing stress and 80% reported experiencing increased appetite under a stress-related event.

During the pre-surgical stage in most bariatric programs, patients are provided with psychoeducation on nutrition and are required to complete a compulsory psychological evaluation in which psychosocial factors including, ways of coping with stress are addressed. The importance of addressing stress in the bariatric population is essential, especially as studies have found a connection between graze eating and snacking and stress 12-month post-surgery (Colles, Dixon, O'Brien, 2008; Boniecka et al., 2017). However, other studies such as by Mack and colleagues (2016) have found that stress scores improved 13.3 months post surgery and the improvement in the post-operative stress scores indicated that patients were better equipped to cope with stressors after surgery.

Aside from the studies by Boniecka and colleagues and Mack and colleagues, there is little research addressing the relationship between stress and weight, especially in the bariatric population. However, the majority of the literature on stress suggests patients' psychosocial well-being improves post-surgery (Buddeberg-Fischer, Klaghofer, Sigrist, & Buddeberg, 2004).

Given that patients are provided with the tools for a favorable surgery outcome in the pre-surgery educational phase, the author of the present study hypothesized that there would be an improvement with perceived stress 6-months post surgery, as measured with the Cohen's Perceived Stress Scale (PSS-10). Unfortunately, study findings were not reflective of the limited body of literature to date examining perceived stress in the bariatric population. Results indicated non-significant perceived stress results at 6-months post surgery. In fact, findings suggested an increase in perceived stress, although not statistically significant. A possible reason for this result could be partly due to the acute lifestyle changes to which a patient may be adjusting to after surgery.

Fat Intake

The initial aim proposed that eating high-fat meat at a higher frequency than those who consume lower-fat forms of protein at Time 2 would experience lower percent weight loss at Time 2. However, this result was found to be non-significant. The Block Dietary Fat screener and the Eating and Diet Questionnaire was intended for this aim. However, the Block Dietary Fat screener included items other than high-fat meat and due to the poor psychometric properties of the Eating an Diet Questionnaire, this aim could not be accurately addressed.

Consequently, in order to address the consumption of high fat meat, specific high fat items were measured for their reliability before analyses were conducted in order to appropriately and more accurately address the proposed hypothesis. However, findings indicated that change in high fat meat between pre- and 6-month post surgery showed no significant relationship with %WL. This finding could partly be due to the fact that the specific question that addressed high fat meat intake was not designed to address high fat meat intake in bariatric patients, as the measure was constructed for general populations. Although there are recommended dietary intake guidelines for the general population, bariatric programs highlight the importance of following a recommended *bariatric diet*. Bariatric patients in comparison to their non-surgical counterparts are encouraged to consume a slightly higher amount of protein (60 to 120 grams daily) and to avoid concentrated sweets and high-fat foods as a way to maintain muscle mass post surgery (Mechanick et al., 2008).

The current literature, although limited, examining fat intake in bariatric patients, suggests that overall patients tend to dislike high-fat and high-sugar products after surgery. It is unclear if this preference is due to consciously avoiding unhealthy food items, taste and palatability changes, conditioned avoidance, conditioned aversion, or change in food preference (Al-Najim et al., 2018). Given the importance of better understanding this relationship, future research should develop a measure that focuses on and is relevant to a bariatric population.

The latter might have been improved by measuring food preference versus fat intake. Taube-Schiff and colleagues (2016) examined nutrition knowledge of bariatric surgery patients over time and found that patients' dietary knowledge improves at 1-month post surgical intervention. With that being said, the required pre-surgical nutrition education classes that patients attend may suggest that there is a conscious effort for pre-operative diet change that is sustained post surgery. Furthermore, research on food preference in both RYGB and vertical sleeve gastrectomy patients suggest a decrease for foods high in fat and carbohydrate content (Halmi, Mason, Falk, Stunkard, 1981; Ammon, Bellanger, Geiselman, Primeaux, Yu, & Greenway, 2015). Instead of hypothesizing changes in high fat content with using general dietary screeners, it may have been beneficial to administer a food preference questionnaire that addresses changes in preference for different types of food intake pre- and post-operatively.

Perceived Stress, Depressed Mood, and Prepared Meals

The present study also focused on the association between perceived stress and depressed mood, and the quantity of consumed prepared meals at home by use of the Eating and Diet Questionnaire. The initial Aim 3 intended to test with the Eating and Diet Questionnaire, a measure that was created by the author of this study. Although a novel concept of focusing on consumption of prepared meals among bariatric patients, the Eating and Diet Questionnaire had two specific items that addressed prepared meals that tested with unacceptable internal consistency. Additionally, five items that addressed meals in general including prepared meals and meals consumed outside the home also tested with unacceptable internal consistency. Despite the unacceptable reliability of this measure, the hypotheses were tested. Findings suggested that non-significant results of patients reporting higher level of perceived stress and depressed mood and consumption of prepared meals at both Time 1 and Time 2.

Aside from the Eating and Diet Questionnaire having unacceptable internal consistency, the measure appeared challenging for patients to complete given how each item response was set up. For example, if a patient responded with eating +21 meals at a fast-food restaurant, their response would not have provided an accurate representation of the frequency of meals. Addressing the proposed aim with unacceptable internal consistency of prepared meal items was not productive or meaningful.

Consequently, the initial proposed hypothesis was modified to account for the Eating and Diet Questionnaire’s unacceptable reliability. The Healthy Eating Questionnaire was created and included reversed Block Dietary Fat Screener items as well as, items from the Dietary Fruit-Vegetable-Fiber Screener in order to assess change in perceived stress, change of healthy eating, and change in depressed mood over time. The results were promising given that there was a statistically significant improvement found in a healthy diet, but only with changes in perceived stress and depressed mood at the pre-surgical visit.

A possible reason for the non-significant correlation between changes in depressed mood and perceived stress with healthy eating at 6-month post surgery may be a result of patients practicing healthy behaviors as they prepare for surgery that is being continued 6-months post surgery. As a result, non-significant findings at the 6-month postsurgical visit suggest that changes in healthy behaviors, mood, and stress that were addressed pre-surgically were sustained post surgery. It is also possible that the 6-month post-operative non-significant results indicate that the surgery itself may have impacted patients' mood, stress, and eating behaviors. Given that surgery reduces or alters patients' gastric size, food volume is thus impacted. Research indicates that reduction in caloric intake at 6-months post surgery could partly be due to change in eating behaviors that result in smaller portion sizes and changes in food preference (Al-Najim et. al., 2018). As previously mentioned, the instrument used to assess prepared meals at home, the Eating and Diet Questionnaire may have not been the appropriate measure for use, which led to modifying the proposed hypothesis and instrument to address changes in healthy diet, perceived stress, and depressed mood.

Diet as a Mediator

Initially it was hypothesized that a healthy diet, as measured by the Block Dietary screeners, would mediate the relationship between perceived stress and percent weight loss, as well as mediate the relationship between depressed mood and percent weight loss. Results indicated no statistically significant relationship between changes in depressed mood, perceived stress, and percent weight loss.

A path analysis was conducted to address the initial hypothesis. Findings suggested that the changes between healthy diet and depressed mood were in the hypothesized direction. There was no indirect or direct effect between depressed mood and healthy diet. However, there was a significant direct effect between changes in healthy diet and %WL. A plausible explanation could be due to bariatric surgery serving as an intervention given the anatomical changes and the restriction of the volume of food in the stomach, thereby suggesting that the surgery was successful with regards to weight loss.

Clinical Implications

The present study examined differences between completers versus non-completers. Findings shed light on the possible reason that patients who had a higher BMI at Time 1 may be associated with an increase in prevalence of negative health symptoms. This subset of the study sample suggests that patients who did not return for their visit at Time 2 may be at a higher risk for adverse effects and poor outcomes post-surgery (Harper, Madan, Ternovits, & Tichansky, 2007). Additionally, non-completers may have health and/or psychological components that could be a possible contributor for lost to follow-up. These findings perhaps provide insight on potential reasons for lost to follow-up among bariatric patients.

Aside from examining differences between completers versus non-completers, the purpose of examining changes in depressed mood and perceived stress was to demonstrate the trajectory of improvement in mood and perceived stress 6-months post-surgery. Offering a snapshot at 6-months post-surgery allows for an opportunity for bariatric clinical teams to intervene by providing interventions that either aim to continue to manage or further address symptoms of depressed mood or levels of perceived stress.

Although most proposed predictions were not supported, the present study nonetheless contributes to literature emphasizing the importance of assessing depressed mood and perceived stress in bariatric patients. For example, given the present study's significant change in depressed mood as measured by PHQ-9, future studies may want to consider administering this instrument. It is beneficial to identify changes in depressed mood in the bariatric population, as it allows for bariatric teams to address any mood concerns that may compromise post surgery outcomes.

In addition to the assessment of depressed mood, the present study sought to examine changes in perceived stress. The present study found that perceived stress had increased although not statistically significant. Addressing perceived stress in the bariatric population may provide further insight on stress-related eating behaviors, which consequently will allow for more interventions that address psychosocial factors that may manifest post surgery.

The present study examined how diet mediates the relationship among depressed mood, perceived stress, and weight. Given that there was a direct effect between changes in healthy diet and weight, the relationship between diet, mood and stress warrants further exploration. Discovering more about the complexities of the interplay between these factors and bariatric surgery outcome could allow a patient's health care team to take a more proactive and individualized approach to preparing patients for bariatric surgery and its required lifestyle changes. Moreover, the findings from the current study highlight the importance of addressing dietary intake throughout all phases of bariatric surgery regardless of patient mood and perceived stress. Therefore, the continuation of addressing dietary changes and its impact on weight after surgery may warrant bariatric clinics to emphasize the role of diet even more than is current practice.

Lastly, the present study only examined the short-term changes (i.e. 6 month timeframe) in depressed mood, perceived stress, and diet. As such, future studies may want to consider long-term follow-up that addresses psychosocial factors and diet, especially in relation to patients who may be presenting with challenges 6-months post surgery or after. Long-term follow-up on changes in mood, perceived stress, and diet may provide further insight on the etiological processes involved across multiple time points.

Study Strengths

The present study has several strengths including using pre- and post assessment measures. The advantage of pre- and post-test measures allows for repeated-measures statistical analyses, which provides for meaningful interpretation of change over time. The present study also adds to the literature by examining the short-term changes over 6 months in mood, stress, and diet in a bariatric population and informing intervention before depressed mood and perceived stress increase over time. Although a longitudinal study design lasting one or more years may have been ideal, methodological problems such as attrition can arise leading to a higher drop-out rate (Gustavson, von Soest, Karevold, & Roysamb, 2012). Additionally, the present study collected data that could be generalizable to the bariatric population by examining changes in perceived stress, depressed mood, and diet across a 6-month time span in the context of a real-world medical setting.

It is also noteworthy that the present study adds to the body of literature with utilization of the PHQ-9 with bariatric patients. Given the significant result in depressed mood, future studies may want to consider using the PHQ-9, a no cost measure, with identifying any possible significant changes in mood throughout the bariatric post-operative process.

Despite the non-significant findings on the mediating relationship of a healthy diet, depressed mood and perceived stress and weight, the present study sought to examine the relationship of dietary changes seen in bariatric patients within a 6-month timeframe. Although the present study utilized dietary measures that were not tailored to the bariatric population, the importance or need for measures that address dietary intake in the bariatric population is needed to adequately understand the short- and long-term diet changes.

Study Limitations

The present study included participants from a single site that may have prevented further inclusion of the types of demographic characteristics seen across the bariatric population in different communities. Consequently, this limitation may have contributed to a lack of generalizability. Further, despite substantial recruitment efforts the study also fell short by nine patients from meeting the number of participates necessary to have adequate statistical power. However, this sample size limitation was minor and may not have been considered a primary impact on the study's non-significant results. Although there were logistical barriers with recruitment, providing financial compensation may have compelled patients to return for their 6-month post-operative visit.

Because the present study was not grant-funded monetary incentive was not included. It is possible that such an incentive may have promoted participation and reduced attrition. Recruiting patients in a clinical setting presents several challenges and thus, including monetary incentive has the advantage of demonstrating appreciation and recognizing participants' contribution to research. However, it is also noteworthy that the existing body of literature suggests that financial incentive can also be compromising to the scientific integrity of research (Zutlevics, 2016).

The present study neglected to collect information on surgery type. Although it was confirmed that a majority of bariatric surgeries conducted at the medical clinic was gastric sleeve, perhaps data on surgery type would have provided further information on the generalizability of any findings regarding gastric sleeve patients given its growing popularity compared to the RYGB. Furthermore, collecting data on surgery type may have offered information on the negative postsurgical consequences of gastric sleeve including, weight and the development of GERD (Bohdjalian et al., 2010).

Another limitation could have been due to the study design. The proposed study examined changes in depressed mood, stress, and diet changes across 6-months. Most studies suggest that weight regain typically occurs 18 to 24 months post surgery (Cambi, Marchesini, & Baretta, 2015). Post-operative patients are considered to be in the “honey moon” stage within the first year (Cambi, Marchesini, & Baretta, 2015). Therefore, a more ideal study design would have included assessments at the times used in the current study and at 12, 18 and 24 months follow-up post surgery.

An additional contributor to the underpowered sample could have been the study’s exclusion criteria regarding revisional bariatric surgeries. Revisional bariatric surgery is a common procedure for patients who have regained weight or failed significant weight loss from a previously performed bariatric surgery. Including revisional surgeries that constitute 13.9% of all the surgical procedures performed in 2015 would have provided a better representation of the general sample of the bariatric population (Qui et al., 2018; English et al., 2018). Additionally, revisional patients adhere to the same pre-surgical program requirements and post-operative appointments that gastric sleeve and RYGB patients follow. However, patients undergoing revisional surgery present more medical and/or psychological complexities compared to patients undergoing bariatric surgery for the first time.

The present study relied mostly on self-report measures to assess depressed mood, perceived stress, and diet. Self-report measures are inclined to social desirability bias or recall bias. However, taking into account the context of the clinical setting, administering lengthier measures or conducting detailed clinical interviews might have deterred patients from participating in the present study. As such, mood, stress, and diet screeners were deemed appropriate substitutes. However, the measures that were administered may not have been as robust in assessing changes in mood, stress, and diet in the bariatric population. Particularly, the Block Fat and Fruit-Vegetable-Fiber Screeners and the Eating and Diet Questionnaire demonstrated poor psychometric constructs within the bariatric population and thus, unable to address the study's assessment of diet changes. Additionally, the order of the assessment measures were not counterbalanced which would have controlled for any order effects.

The present study also neglected to include food diaries in addition to the dietary screeners. Including food diaries may have captured dietary changes more closely than utilizing the diet measures alone. However, assessing diet changes with food diaries could have substantially burdened participants or could be viewed as less effective in measuring "usual intake" due to heightened awareness (Ortega, Perez-Rodrigo, & Lopez-Sabaler, 2015).

Another area that the present study did not address was social support. Studies have found an association with greater weight loss after bariatric surgery with social support (Livhits et al., 2011). Additionally, support group attendance is highly encouraged post-bariatric surgery, and studies indicate an association between social support and greater post-operative weight loss (Livhits et al., 2011). However, there are no standardized guidelines with regards to the structure of how bariatric support groups should be held (Livhits et al., 2011) and therefore, this variation may add to the complexity of understanding the role of post-operative care. Nevertheless, the literature indicates that the provision of support groups may mitigate any possible post–operative issues related to weight loss and diet (Livhits et al., 2011). Including social support may have provided further insight on post-operative outcomes.

Along with social support, the present study did not address the relationship between coping and stress. Part of the pre-operative process is to assess for any emotional factors (i.e., stress) that may be related to a patient's coping style with regards to eating behaviors (i.e., emotional eating, grazing, binge eating) as well as body image (Pona et al., 2016). The connection between stress and coping are typical factors that play an integral role before and after bariatric surgery (Ogle & Park, 2016) and an area that warrants further exploration.

In addition to the relationship between coping and stress, the present study also did not address the influence of personality traits and the possible role it has on post-operative outcomes (Generali & Panfilis, 2018). Studies have failed to adequately address the relationship between pre-operative psychiatric comorbidity including general psychopathology, anxiety, depression, and success following bariatric surgery (Generali & Panfilis, 2018). Including a personality measure such as the MMPI-2-RF (Ben-Porath & Tellegen, 2008) may have provided further understanding of the psychosocial functioning of bariatric surgery patients. Furthermore, in some bariatric clinics, the MMPI-2-RF is included as a part of pre-surgical psychological evaluation process (Marek et al., 2013), and not a measure administered to patients in a medical clinical setting for research purposes.

Future Directions

Given the rise of obesity rates, both globally and nationally, bariatric surgery still stands as the most effective weight loss option for individuals with a BMI equal to or greater than 40 (Vetter et al., 2012). The complexity of obesity and surgical interventions (i.e., bariatric surgery) combined with psychological and dietary factors warrant further exploration in the understanding of the psychological and diet components that may contribute to weight regain in the bariatric population. Consequently, the literature lacks studies addressing how changes in mood and diet quality post bariatric surgery may be a possible contributor to suboptimal weight loss. Due to 10% to 15% weight regain post bariatric surgery more emphasis towards understanding factors that are contributing to suboptimal weight loss is imperative.

The etiology of weight regain is multifactorial and is related to diet and nutrition, weight history and BMI, and psychosocial factors (Velapati et al., 2018). Given this multifactorial complexity, continuation of examining these factors is warranted. Although the present study failed to understand the complexity of depressed mood, perceived stress, and diet, addressing these components may provide insight on the possible challenges that patients may meet post bariatric surgery.

Further, the present study sought to understand how diet mediates the relationship between depressed mood and perceived stress and weight loss. However, the literature lacks diet measures that effectively capture the bariatric diet. To start, future studies may want to consider constructing a valid dietary measure that is normed on the bariatric population. To the knowledge of the author of the current study, there are no developed dietary measures that are tailored specifically for the bariatric population. Although food diary records are commonly used methods for assessing dietary intake, food diaries fail to capture eating patterns and eating context (Pendergast, Ridgers, Worsley & McNaughton, 2017).

Bariatric patients attend diet and nutrition classes during the pre-operative phase and are educated on the recommended dietary changes that are expected to be sustained post surgery. However, in most bariatric programs there are no follow-up post-operative dietary assessments, only scheduled medical visits with the bariatric surgeon. Additionally, psychological and/or diet follow-ups are only considered as needed or if requested by patients. As such, establishing formal post-operative dietary and behavioral support in bariatric programs similar to that of the pre-operative nutrition classes patients are recommended to attend, may address the rising prevalence of weight regain.

Conclusions

In sum, the present study sought to contribute to existing research on assessing depressed mood, perceived stress, and diet changes within the first 6-months after bariatric surgery. Results corroborated existing literature on the improvement in depressed mood post surgery. However, the study failed to support that a healthy diet mediates mood, perceived stress, and weight loss in post-operative bariatric patients at 6-months. Despite having mostly non-significant findings, the present study utilized depressed mood and perceived stress measures that were brief and easy to administer and were appropriate for a medical clinical setting. However, future research is warranted in addressing the relationships of perceived stress, depressed mood, and diet on the effects of weight regain in the bariatric population.

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APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

Age: _____

Male____ Female ____

Visit Type:
- ❑ Baseline (Pre-surgical visit)
- ❑ 6 month post-op

Race/Ethnic Background:
- ❑ Caucasian/White
- ❑ African-American/Black
- ❑ Native American
- ❑ Hispanic American
- ❑ Asian American
- ❑ Bi-racial
- ❑ Other:

Highest Level of Education:
- ❑ Less than 12 years
- ❑ High School Graduate
- ❑ Trade, Vocational, Associates degree
- ❑ Bachelor’s degree
- ❑ Post-bachelorette study/degree

Marital Status:
- ❑ Never Married/Single
- ❑ Married
- ❑ Divorced or Separated
- ❑ Widowed
- ❑ Living in a marriage-like relationship

Employment:
- ❑ Not working
- ❑ Retired
- ❑ Homemaker
- ❑ Employed (full-time or part-time)
- ❑ Student
- ❑ Disabled
- ❑ Other:

Data Checklist

	Baseline Visit	**6-Month Visit**
Height (cm)		
Weight (kg)		
BMI (kg/m^2)		
PHQ-9		
PSS-10		
Fat Screener		
Fruit/Fiber Screener		

APPENDIX B

PROTEIN GUIDELINE SHEET

How much do we need?

Individuals who have had bariatric surgery need approximately 60-80 grams of protein a day.

Good sources of protein:

*low fat

*once a day, max

What is a

Meat Poultry Fish	Milk* Cheese* Yogurt*	Soy Products Eggs	Beans Lentils Seeds Nuts*
		 	

serving?

Adapted from www.move.va.gov and ASMBS nutritional guideline

3-4 ounces of meat, poultry, or fish = 21-30 grams protein
1 ounce of beef = 7 grams of protein
1 ounce of deli turkey/lean ham = 4.5 grams protein
2 medium eggs = 14 grams protein
½ cup cooked beans or lentils = 7 grams protein
1 tablespoon of seeds or nuts = 2-7 grams protein
2 tablespoons of creamy natural peanut butter = 9 grams protein
8 ounces of low fat or skim milk or yogurt = 8 grams protein
2 ounces of low fat cheese = 14 grams protein
1 ounce of firm tofu = 2 grams protein
1 Black bean burger patty = 11 grams protein
1 Veggie burger patty = 11 grams protein

APPENDIX C

EATING AND DIET QUESTIONNAIRE

ID: ____________________ IRB #________________________

Date: ______________________

Baseline Visit

Please *circle* the best answer. Fill out a comment if responses do not represent your answer.

1. On average, how many meals are you eating in a week?

   0 3 6 9 12 15 18 21 +21

Comment:

2. On average, how often are you cooking and preparing meals (from basic ingredients) in a week?

   0 3 6 9 12 15 18 21 +21

Comment:

3. On average, how often is your partner or family member cooking and preparing meals (from basic ingredients) in a week?

   0 3 6 9 12 15 18 21 +21

Comment:

4. On average, how many of your meals are at a fast-food restaurant (e.g., Taco Bell, McDonald's) in a week?

   0 3 6 9 12 15 18 21 +21

Comment:

5. On average, how many of your meals are at a sit-down restaurant (e.g., Applebee's, Chili's) in a week?

   0 3 6 9 12 15 18 21 +21

Comment:

6. On average, how often are your meals (i.e., fast food) delivered to your home in a week?

   0 3 6 9 12 15 18 21 +21

Comment:

7. On average, how often are you skipping meals in a week?

0 3 6 9 12 15 18 21 +21

Comment:

8. On average, how many snacks are you eating in a week?

0 2 4 6 8 10 12 14 +14

Comment:

9. On average, how often are you grazing (i.e., frequent consumption of relatively small amounts of food) in a week?

0 2 4 6 8 10 12 14 +14

Comment:

10. On average, how many grams of protein are you consuming in a week?

0 30 60 90 120 150 180 230 260 290 320 350 380 410 +410

Comment:

EATING AND DIET QUESTIONNAIRE

ID: ____________________ IRB #________________________

Date: ______________________

6-Month Visit

Please *circle* the best answer. Fill out a comment if responses do not represent your answer.

1. On average, how many meals (on average) are you eating in a week?

0 3 6 9 12 15 18 21 +21

Comment:

2. On average, how often are you cooking and preparing meals (from basic ingredients) in a week?

0 3 6 9 12 15 18 21 +21

Comment:

3. On average how often is your partner or family member cooking and preparing meals (from basic ingredients) in a week?

0 3 6 9 12 15 18 21 +21

Comment:

4. On average, how many of your meals are at a fast-food restaurant (e.g., Taco Bell, McDonald's) in a week?

0 3 6 9 12 15 18 21 +21

Comment:

5. On average, how many of your meals are at a sit-down restaurant (e.g., Applebee's, Chili's) in a week?

0 3 6 9 12 15 18 21 +21

Comment:

6. On average, how often are your meals (i.e., fast food) delivered to your home in a week?

0 3 6 9 12 15 18 21 +21

Comment:

7. On average, how often are you skipping meals in a week?

0 3 6 9 12 15 18 21 +21

Comment:

8. On average, how many snacks are you eating in a week?

0 2 4 6 8 10 12 14 +14

Comment:

9. On average, how often are you grazing (i.e., frequent consumption of relatively small amounts of food) in a week?

0 2 4 6 8 10 12 14 +14

Comment:

10. On average, how many grams of protein are you consuming in a week?

0 30 60 90 120 150 180 230 260 290 320 350 380 410 +410

Comment:

APPENDIX D

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✔" to indicate your answer)*	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING __0__ + ______ + ______ + ______

=Total Score: ______

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

APPENDIX E

COHEN PERCEIVED STERSS

COHEN PERCEIVED STRESS

The following questions ask about your feelings and thoughts during THE PAST MONTH. In each question, you will be asked HOW OFTEN you felt or thought a certain way. Although some of the questions are similar, there are small differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don t try to count up the exact number of times you felt a particular way, but tell me the answer that in general seems the best.

For each statement, please tell me if you have had these thoughts or feelings: never, almost never, sometimes, fairly often, or very often. (Read all answer choices each time)

	Never	Almost Never	Sometimes	Fairly Often	Very Often
B.1. In the past month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
B.2. In the past month, how often have you felt unable to control the important things in your life?	0	1	2	3	4
B.3. In the past month, how often have you felt nervous or stressed?	0	1	2	3	4
B.4. In the past month, how often have you felt confident about your ability to handle personal problems?	0	1	2	3	4
B.5. In the past month, how often have you felt that things were going your way?	0	1	2	3	4
B.6. In the past month, how often have you found that you could not cope with all the things you had to do?	0	1	2	3	4
B.7. In the past month, how often have you been able to control irritations in your life?	0	1	2	3	4

B.8. In the past month, how often have you felt that you were on top of things?	0	1	2	3	4
B.9. In the past month, how often have you been angry because of things that happened that were outside of your control?	0	1	2	3	4
B.10. In the past month, how often have you felt that difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Perceived Stress Scale Scoring

Each item is rated on a 5-point scale ranging from never (0) to almost always (4). Positively worded items are reverse scored, and the ratings are summed, with higher scores indicating more perceived stress.

PSS-10 scores are obtained by reversing the scores on the four positive items: For example, 0=4, 1=3, 2=2, etc. and then summing across all 10 items. Items 4, 5, 7, and 8 are the positively stated items.

Your Perceived Stress Level was ________

Scores around 13 are considered average. In our own research, we have found that high stress groups usually have a stress score of around 20 points. Scores of 20 or higher are considered high stress, and if you are in this range, you might consider learning new stress reduction techniques as well as increasing your exercise to at least three times a week. High psychological stress is associated with high blood pressure, higher BMI, larger waist to hip ratio, shorter telomere length, higher cortisol levels, suppressed immune function, decreased sleep, and increased alcohol consumption. These are all important risk factors for cardiovascular disease.

APPENDIX F

BLOCK DIETARY FAT SCREENER

Dietary Fat Screener©

Name :

Age:

Sex: ○ Male ○ Female

Think about your eating habits over the past month. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out. Mark one bubble for each food.

Meals and Snacks	(0) 1/ MONTH or less	(1) 2-3 times a MONTH	(2) 1-2 times a WEEK	(3) 3-4 times a WEEK	(4) 5+ times a WEEK	Score
Hamburgers, ground beef, meat burritos, tacos	○	○	○	○	○	______
Beef or pork, such as steaks, roasts, ribs, or in sandwiches	○	○	○	○	○	______
Fried chicken	○	○	○	○	○	______
Hot dogs, or Polish or Italian sausage	○	○	○	○	○	______
Cold cuts, lunch meats, ham (not low-fat)	○	○	○	○	○	______
Bacon or breakfast sausage	○	○	○	○	○	______
Salad dressings (not low-fat)	○	○	○	○	○	______
Margarine, butter or mayo on bread or potatoes	○	○	○	○	○	______
Margarine, butter or oil in cooking	○	○	○	○	○	______
Eggs (not Egg Beaters or just egg whites)	○	○	○	○	○	______
Pizza	○	○	○	○	○	______
Cheese, cheese spread (not low-fat)	○	○	○	○	○	______
Whole milk	○	○	○	○	○	______
French fries, fried potatoes	○	○	○	○	○	______
Corn chips, potato chips, popcorn, crackers	○	○	○	○	○	______
Doughnuts, pastries, cake, cookies (not low-fat)	○	○	○	○	○	______
Ice cream (not sherbet or non-fat)	○	○	○	○	○	______

Fat Score = __________

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APPENDIX G

BLOCK DIETARY FRUIT-VEGETABLE-FIBER SCREENER

Dietary Fruit-Vegetable-Fiber Screener©

Name :

Age:

Sex: ○ Male ○ Female

Think about your eating habits over the past month. About how often do you eat each of the following foods? Remember breakfast, lunch, dinner, snacks and eating out. Mark one bubble for each food.

Fruits and Vegetables and Fiber	(0) Less than 1 / WEEK	(1) Once a WEEK	(2) 2-3 times a WEEK	(3) 4-6 times a WEEK	(4) Once a DAY	(5) 2+ a DAY	Score
(1) Fruit juice, like orange, apple, grape, fresh, frozen or canned (Not sodas or other drinks.)	○	○	○	○	○	○	_____
(2) How often do you eat any fruit, fresh or canned? (Not counting juice.)	○	○	○	○	○	○	_____
(3) Vegetable juice, like tomato juice, V-8, carrot	○	○	○	○	○	○	_____
(4) Green salad	○	○	○	○	○	○	_____
(5) Potatoes, any kind, including baked, mashed or French fried	○	○	○	○	○	○	_____
(6) Vegetable soup, or stew with vegetables	○	○	○	○	○	○	_____
(7) Any other vegetables, including string beans, peas, corn, broccoli or any other kind	○	○	○	○	○	○	_____
(8) Fiber cereals like Raisin Bran, Shredded Wheat or Fruit-n-Fiber	○	○	○	○	○	○	_____
(9) Beans such as baked beans, pinto, kidney, or lentils (not green beans)	○	○	○	○	○	○	_____
(10) Dark bread such as whole wheat or rye	○	○	○	○	○	○	_____
	Fruit-Vegetable Score (Sum for items 1-7) =						_____
	Fruit-Veg-Beans Score (Sum of items 1-10) =						_____

BLOCK DIETARY DATA SYSTEMS
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VITA

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Ph.D.	Clinical Psychology (*expected June 2019)* The Virginia Consortium Program in Clinical Psychology Norfolk, Virginia
M.A.	Counseling Psychology (awarded May 2011) University of Denver Denver, Colorado
B.S.	Psychology, Minor in Anthropology (awarded May 2007) James Madison University Harrisonburg, Virginia

Selected Publications

Volger, S, Wadden T.A., Sarwer, D.B., Moore, R.H., Chittams, J., Diewald, L., **Panigrahi, E.**, Berkowitz, R.I., Schimitz, K., Vetter, M.L. (2013). Changes in Diet, Physical Activity, and Related Behaviors in a Two-Year Weight Loss Intervention. *International Journal of Obesity, 37,* S12-S18. doi:10.1038/ijo.2013.91

Vetter, M.L., Wadden, T.A., Chittams, J., Diewald, L, **Panigrahi, E**., Volger, S., Sarwer, D.B., Moore, R.H. (2013). Effect of Lifestyle Intervention on Cardiometabolic Risk Factors: Results from the POWER Trial. *International Journal of Obesity, 37,* S19-S24. doi:10.1038/ijo.2013.92

Selected Presentations

Panigrahi, E.R. (2019, June). *Psychological clearance status and weight loss outcomes in bariatric surgery patients: To clear or not to clear.* Presenter at West Virginia University School of Medicine Psychiatry Grand Rounds, Morgantown, West Virginia.

Panigrahi, E.R. & Peterson, N.D. (2016, March). *Ready, Set, Scan: Acute Changes in Mood after Visual Body Scan among Bariatric Candidates.* Poster presenter at the 37th annual meeting of the Society of Behavioral Medicine conference, Washington, D.C.